

IN THE SEVENTH JUDICIAL DISTRICT COURT OF EMERY COUNTY  
STATE OF UTAH

HEAL UTAH, et al.,

Plaintiffs,

Case No. 120700009

vs.

KANE COUNTY WATER CONSERVANCY

DISTRICT, et al.,

Defendants.

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TRANSCRIPT OF TRIAL - DAY FOUR

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BEFORE THE HONORABLE GEORGE M. HARMOND

SEPTEMBER 26, 2013

50 West Broadway, Suite 900, Salt Lake City, UT 84101  
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APPEARANCES:

FOR THE PLAINTIFFS:

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-and-

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1 WITNESSES:

2 MARK N. COOPER

3 Direct Examination by Mr. Flitton

4 Cross-Examination by Mr. Wright

5 Re-Direct Examination by Mr. Flitton

6 Re-Cross-Examination by Mr. Wright

7

8 HAROLD M. TYUS, PH.D.

9 Direct Examination by Ms. Swensen

10 Cross-Examination by Mr. Wright

11 Cross-Examination by Ms. Valdes

12 Re-Direct Examination by Ms. Swensen

13

14 CHARLES H. NORRIS

15 Direct Examination by Mr. Flitton

16 Cross-Examination by Mr. Wright

17 Re-Direct Examination by Mr. Flitton

18 Cross-Examination by Ms. Valdes

19

20 ROBERT GRABER (RE-CALLED)

21 Direct Examination by Mr. Wright

22 Cross-Examination by Ms. Swensen

23

24 NILS DIAZ, PH.D. (RE-CALLED)

25 Direct Examination by Mr. Wright

1 PRICE, UTAH; THURSDAY, SEPTEMBER 26, 2013; 8:30 A.M.

2 BAILIFF: All rise. Seventh District Court, in  
3 and for Carbon County, State of Utah, is now in  
4 session, the Honorable Judge George M. Harmond, Jr.  
5 presiding.

6 THE COURT: Good morning ladies and gentlemen.  
7 Please be seated. We'll be on the record this morning,  
8 again, in Emery County Case Number 1207009, Heal Utah,  
9 et al. v. Kane County Water Conservancy District, et  
10 al. The Court will note that counsel for all parties  
11 are present. Ready to call a witness, Mr. Flitton?

12 MR. FLITTON: I am, Your Honor.

13 THE COURT: Great.

14 MR. FLITTON: The Plaintiffs calls Dr. Mark  
15 Cooper.

16 THE COURT: Dr. Cooper, if you would come forward,  
17 Sir, and raise your right hand, please.

18 MARK N. COOPER, PH.D. called as a witness by the  
19 Plaintiffs, being first duly sworn, was examined and  
20 testified on his oath as follows.

21 THE COURT: Please have a seat in the witness  
22 chair, please, Sir.

23 DIRECT EXAMINATION

24 BY MR. FLITTON:

25 Q. Good morning, Dr. Cooper.

1 A. Morning.

2 Q. Could you please state your full name for the  
3 record?

4 A. Mark N. Cooper.

5 Q. Okay and could you please tell us about your  
6 educational background?

7 A. I have a Ph.D. from Yale University where I  
8 was a Fulbright and Yale University fellow. I am  
9 present a Senior Fellow for Economic Analysis at the  
10 Institute for Energy and Environment at Vermont Law  
11 School where I do the nuclear issue. I'm Director of  
12 Research at the Consumer Federation of America where I  
13 do energy efficiency issues. I'm also a fellow at  
14 Fordham University at Donald McGannon Center for  
15 Communications Research. I do media and silicon  
16 flatirons here, in Colorado, where I do technology  
17 issues.

18 With respect to nuclear power and electricity, my  
19 first case was over 30 years ago. I appeared in the  
20 Grand Gulf II Nuclear Power Station case in  
21 Mississippi. That was my first public utility  
22 commission case. I've testified about 400 times since  
23 then, roughly split 250 at state public utility  
24 commissions, public service commissions and federal  
25 legislatures, state legislatures.

1           With respect to nuclear and specifics, I did the  
2 Grand Gulf II case. I worked a lot, in the 1980's, on  
3 construction work in progress. These days, it's called  
4 advanced cost recovery, the funding of major utility  
5 projects. In the '90's, I worked on electricity  
6 restructuring, and starting at the height of the  
7 renaissance, about 2008, 2009, I began to look at the  
8 question of the economics of nuclear reactors and,  
9 since 2008, I have, I guess, written six major  
10 documents, testified at public utility commissions in  
11 Florida, twice, and South Carolina. Testified at  
12 legislatures in Minnesota, Washington and Ottawa and  
13 made a presentation to the City Council of San Antonio,  
14 which is a public power entity that was looking at the  
15 South Texas project.

16           Q. And what were you asked to do with respect to  
17 this case?

18           A. Well, I was asked to look at, I guess, two of  
19 the four criteria in the statute having to do with the  
20 granting of water rights. So, I was asked to look,  
21 specifically, at economic feasibility and the ability  
22 to financially complete the project. That analysis has  
23 some implications for the public welfare, but the  
24 primary things I was asked to look at were the  
25 feasibility and ability to finance it and, obviously, I

1 concluded that the project is not feasible and cannot  
2 be financed.

3 Q. Okay. Let's take each one of those prongs,  
4 just to try to keep things simple, and talk about each  
5 one. The first one you mentioned was economic  
6 feasibility, correct?

7 A. Yes.

8 Q. Okay and what was the methodology you used to  
9 arrive at your opinions regarding economic feasibility?

10 A. Well, as I said, and I did in the public  
11 utility commission cases and all of the research  
12 reports I worked on, the question of economic  
13 feasibility is a question of what's available in the  
14 marketplace. If you have a product that is over-  
15 priced, you can't sell it in the marketplace and,  
16 therefore, it is not feasible and public utility  
17 commissions look very hard at the relative cost of  
18 alternatives available and, if you look at the numbers  
19 from the Energy Information Administration, from Wall  
20 Street firms, from public utility commissions, which I  
21 do, you conclude that nuclear is just about the most  
22 expensive thing. Solar is a little bit more expensive  
23 and carbon capture technologies added to fossil fuels  
24 might be more expensive, but nuclear has gotten very  
25 expensive.

1           If you go back and look at the nuclear  
2           renaissance, as it was called, if you will go back to  
3           the early 2000's and look at those first cost  
4           estimates, they were ridiculously low and, so, the  
5           numbers that are being used today are three and four  
6           times as those original numbers.

7           In the meantime, the cost of alternatives has come  
8           down. Solar has come down. Wind has come down.  
9           Efficiency was always the least cost approach. Natural  
10          gas had a blip up in the late 2000's, but it has  
11          plummeted and, today, it's back at its historical  
12          levels.

13          So, you have a number of alternatives that are  
14          much less costly, that are low-carbon, some zero  
15          carbon, some low carbon. You have technological  
16          developments ongoing in the marketplace for those  
17          technologies and for storage. It's an area of  
18          tremendous interest and activity in terms of lowering  
19          the cost of storage, which would have a huge impact on  
20          the way you operate the grid on the value of  
21          [inaudible] If you can start to store electricity,  
22          they would become much more valuable. The ability to  
23          operate the grid would become much more flexible.

24          So, you look at that and I concluded, as the  
25          overwhelming majority of people who propose to build



1 new nuclear reactors have concluded, it's uneconomic  
2 and, so, if you look at the number of projects that  
3 were proposed around 2008, when the renaissance was in  
4 full bore, there were 22 or 23 projects proposed.  
5 Eighteen of them are gone. They just have been  
6 mothballed, cancelled, abandoned. So, there are only a  
7 very small number that are still active.

8 Only two are under construction and both of those  
9 have two characteristics that are really important.  
10 They are brown field sites. So, they are reactors to  
11 be built, but there's already a reactor which means the  
12 site has developed a certain amount of facilities  
13 already there and they are also supported by advanced  
14 cost recovery. That is what used to be called  
15 construction work-in-progress or CWIP.

16 So, the ratepayers in Georgia and South Carolina  
17 are bearing all of the risk of those projects and it  
18 turns out that that is a necessary condition for moving  
19 forward. No project has moved to the stage of having a  
20 contract if the state hadn't already passed an advanced  
21 cost recovery law.

22 Q. Let me ask you why is that? Why is it that  
23 it's necessary?

24 A. Well, the simple fact of the matter is that  
25 nuclear power cannot be financed in capital markets

1 today, normal capital markets. It's too risky, too  
2 costly. No one has done it in the nuclear renaissance.  
3 Everyone who proposed a merchant plant is gone, but  
4 for this one, as I understand it. Even utilities that  
5 exist in states without advanced cost recovery have  
6 cancelled and abandoned their plans.

7 So, the risk and cost of a nuclear reactor makes  
8 it impossible to finance it in capital markets and, so,  
9 Georgia and South Carolina have decided to tax the  
10 ratepayers to pay for it, to raise the money from the  
11 rate payers.

12 Q. Okay. Let's go back, a little bit, for a  
13 second on the feasibility issue. So, when you examine  
14 economic feasibility, how do you go about that?

15 A. Well, and in my analysis, you start from  
16 what's called the levelized cost of energy or  
17 electricity. All the public utility commissions do  
18 that. They—you want to take out—you want to compare  
19 apples-to-apples and some projects take a long time to  
20 develop, like nuclear reactors. Some are very quick.  
21 So, you want to levelize the cost of power coming out.  
22 Costs, in the future, are discounted to the present.  
23 A dollar next month, next year, is less valuable than a  
24 dollar today. If I asked you to give me a dollar and  
25 say I'll give it to you back in ten years, you'd say

1 wait a minute. Where's my interest? So, you want to  
2 levelize the cost.

3 So, you start from levelized cost but, then, we  
4 add the question of risk, uncertainty and vagueness.  
5 You have to look at these, particularly nuclear, which  
6 is very long-lived, and the question becomes, well,  
7 yeah. So, today, it looks like this, but what does the  
8 future look like? What's the long-term prospects? And  
9 there are a number of important factors that enter  
10 there, and I look at that in my testimony, that  
11 actually proposed a very formal way to do that.

12 If you look at Wall Street, for instance, and you  
13 ask a Wall Street broker how do you build your  
14 portfolio, Wall Street brokers do--build portfolios by  
15 balancing risk and reward. If I can find an asset that  
16 has a higher reward, with the same amount of risk, I'm  
17 going to add it because my expected pay-off is going to  
18 be higher, or even if it's got a somewhat lower reward,  
19 but a much lower risk, that may be attractive to add to  
20 my portfolio.

21 So, you look at risk hedging. You look at real  
22 option analysis. This is another Wall Street approach  
23 where the question, there, is, if I keep my options  
24 open, will I learn more, in an uncertain world, to make  
25 better investments and, so, the more information I can

1 gather, over time, the better off I may be, but the  
2 real issue is to remember that options have costs.  
3 They're not free. So, by keeping your option open,  
4 you're paying some cost; that is, you're not doing  
5 something else, which is the opportunity cost. The  
6 question is what are you going to learn and can you  
7 actually execute the option?

8 Most options terminate at some point. So, you pay  
9 someone for the right to do something. So, you  
10 actually pay someone when you put down an option and  
11 there comes a point in time where you either exercise  
12 your option or it goes away, because you've only paid  
13 for that long. So, most options are not open-ended.  
14 They have a finite time frame.

15 If you put it in that framework, If you look at  
16 nuclear power, which has huge sunk costs; that is, you  
17 have to spend a lot of time and money to build them  
18 and, while you're building it, the world may be  
19 changing. So, you're at risk. That investment may go  
20 bad and, frankly, if you look at U.S. nuclear history,  
21 more than half the original orders were cancelled  
22 because things changed and it isn't any flexible  
23 investment. It's not the kind of thing you want to do  
24 in a complex environment and that's why most investors  
25 stay away from it.

1           So, if you look at nuclear power and put it into  
2 this framework of risk, we don't know what they will  
3 cost. Certainly, the original history of nuclear in  
4 the U.S., the first estimates were a quarter of the  
5 final plans.

6           If you look at the nuclear renaissance, and I have  
7 a graph I've done which has put this all on one page,  
8 the original estimates were way too low and, so, you  
9 don't know what this will cost. Most people think it's  
10 pretty darn expensive. So, there's uncertainty with  
11 nuclear, cost uncertainty. The price of uranium is  
12 rising. The price of operating old reactors, the cost  
13 of operating old reactors, is rising and, so, there are  
14 uncertainties and risk with nuclear. Clearly, gas  
15 price risk is a problem. We look at trends for wind  
16 and solar. Don't have fuel price risks, but they have  
17 operating risks, etc.

18           If you put those on a graph, it turns out nuclear  
19 is even less attractive in this portfolio view than it  
20 was in a simple levelized cost point of view. So,  
21 that's what you do and analysts can do that and, then,  
22 you look out at the real world and, if you look at the  
23 real world, all of the merchant reactors have gone  
24 away. All of the normal rate regulated reactors have  
25 gone away from the nuclear renaissance. We're down to

1 two under construction in states with severe shifting  
2 of risk to rate payers.

3 Now, Florida—let me finish. Now, Florida had two  
4 projects proposed. I testified against both of those.  
5 One of them has gone away. The lead reactor has been  
6 abandoned. The FPO reactor, which came up yesterday,  
7 the utility says they don't know if they're going to  
8 build it. They've made it absolutely clear they have  
9 not made a determination to build and there's some  
10 dispute, in Florida, about whether you should be  
11 allowed to collect, under the advanced cost recovery  
12 statute, if you don't actually have an intent to build  
13 and that may be resonant, here, given the statute.

14 So, that's where we are today. It's uneconomic  
15 and, because it's uneconomic, it can't be financed.

16 Q. Okay. Let me just clarify one thing. You  
17 said there's two projects currently being built,  
18 correct?

19 A. Yes, with engineering procurement construction  
20 contracts.

21 Q. Okay and what are those two projects?

22 A. That would be the Summer reactor in South  
23 Carolina and the Vogtle reactor in Georgia.

24 Q. Okay and how many reactors are at those two  
25 projects, each?

1           A. Well, I believe Summer is a single unit—or,  
2 maybe—well, Summer has a single existing unit and two  
3 new units and Vogtle is two existing units and two new  
4 units. So, they're being built in two and, if you look  
5 at the economic analysis, and I've done that, you got  
6 to build them in twos because of the cost of the second  
7 one, of doing the combination, is much lower than doing  
8 it as ones and green field sites have been much more  
9 expensive, at least in the projections, than the brown  
10 field sites because there's infrastructure there  
11 already.

12           Q. Okay. Let's talk, a little bit, about the  
13 cost of nuclear power in terms of the product. What  
14 analysis did you do in analyzing what the long-term  
15 outlook is for the cost of nuclear power?

16           A. Well, we have a series of estimates from a  
17 variety of people. It started out with academic  
18 experts in the early nuclear renaissance and those  
19 numbers were way too low and, then, we had some  
20 utilities start to make estimates and those numbers  
21 were much higher than the original estimates. We've  
22 had Wall Street analysts and other folks who look at it  
23 and see much higher numbers, eventually, because it  
24 turns out that all of the reactors on the construction  
25 have suffered from delays, quality control problems.

1           So, it's remarkable how close the process of  
2 building new reactors in the renaissance looks almost  
3 like—Arnie called it the first renaissance. It used to  
4 be called the great bandwagon market is what they  
5 actually called it in the 1970's and the bandwagon  
6 crashed. More reactors were cancelled than were built,  
7 but the problems they had, in terms of scheduling and  
8 quality control, have just been replicated. It's  
9 amazing because they were determined to avoid it and  
10 they have failed to do so and these are both  
11 Westinghouse reactors.

12           So, they are way behind schedule. The budgets  
13 have moved around. There's court cases litigating cost  
14 overruns. It looks just like the 1970's all over  
15 again.

16           Q. What about alternatives? Compare some  
17 alternative energy sources to nuclear power.

18           A. Well, again, I have relied upon a series of  
19 estimates from, as I said, at least half a dozen  
20 entities and all different kinds of entities. In the  
21 report that I wrote for you folks, I relied,  
22 particularly, on John Rowe of Exelon. He's the CEO of  
23 Exelon. It's the largest nuclear utility in the U.S.  
24 and he concluded, very quickly, moving from 2008 to  
25 2010, that nuclear is not an attractive option and he



1 began giving speeches explaining why people needed to  
2 be careful about that and he gave a couple speeches in  
3 Washington where he showed his numbers.

4 He showed the numbers from the PJM power pool and  
5 all of them show that nuclear is way down the list of  
6 things you would do. Frankly, in the PJM analysis,  
7 that used to be Pennsylvania, Jersey, Maryland and they  
8 shortened it to PJM. It's, actually, I think, the  
9 oldest power pool and the tightest power pool in the  
10 country. So, it's been a tight power pool for a long  
11 time.

12 The only thing that nuclear is less costly than is  
13 solar photovoltaics. Everything else is less costly  
14 than nuclear and less costly and PJM, it's interesting,  
15 they do it in two terms. They do it in cost per  
16 kilowatt hour and they also do it in cost per ton of  
17 carbon abated, since that may be a [inaudible] and it's  
18 still at the end of the list.

19 So, John Rowe, CEO of Exelon, has decided that  
20 nuclear is not in his portfolio. Exelon cancelled  
21 their new build. Exelon has, actually, cancelled a  
22 bunch of upgrades. The large major upgrades, depending  
23 on the age of the reactor, when you go in for a major  
24 overhaul, they get old, you can boost the power if you  
25 spend the money to add new technology and these come on

1 as much as a 100 megawatts and, as far as I can tell,  
2 there have been a dozen cancelled in the last two  
3 years.

4 So, there's no nuclear major upgrade ongoing  
5 today. A couple have been completed and they've proved  
6 to be very costly, much more costly than building a new  
7 gas plant, for instance, than building wind. So, even  
8 the upgrades are, now, uneconomic and they have been  
9 abandoned.

10 Q. So, what kind of price difference is there  
11 between, say, gas powered electricity produced and  
12 nuclear power?

13 A. Well, it depends. There's a range of  
14 differences. If you look at the Energy Information  
15 Administration, which was always a little bit favorable  
16 to nuclear, I believe it's about fifty percent. If you  
17 do advance combined cycle plants, it's even a bit more  
18 than fifty percent. If you look at Lizard, a Wall  
19 Street analyst who has done six rounds of this stuff  
20 and includes efficiency, which is really important  
21 since that's the least cost, it's close to fifty  
22 percent and, then, you have a range that the California  
23 Energy Commission sees it as 150 percent. It's just  
24 substantially more costly than gas and one of the  
25 problems with a lot of the analysis is that the

1 utilities choose only to look at gas and that's a  
2 mistake.

3 There are lots of other alternatives. The  
4 argument, of course, they make is that we need base  
5 load and the answer is that, maybe, we don't need so  
6 much base load anymore. We've got efficiency. We've  
7 got decentralized resources. We have an information  
8 revolution. We have Smart Grid coming along. We have  
9 investments in store.

10 So, the notion of we've got to do base load is,  
11 basically, a 1950's concept and, therefore, we should  
12 only compare gas and nuclear and, maybe, coal misses  
13 the really dynamic area of technological innovation in  
14 the electricity phase.

15 So, one of the things I have insisted on, in each  
16 of the cases and the analyses, is look at the full  
17 range of alternatives and one of the really attractive  
18 things about the smaller scale alternatives is the  
19 following. We've, obviously, had a dramatic reduction  
20 in demand growth and that stretches out the time  
21 horizon for needing large increments of capacity. That  
22 lets you do real, real option analysis and what you do  
23 is you look and say wait. If I can meet my needs with  
24 a small quick to market investment—wind takes a year or  
25 so. Solar takes a year. Efficiency takes a year or

1 two to build-up to that—I can buy more and more time.

2 So, I want to invest in these that keep my options  
3 open at a lower cost than the less attractive  
4 alternatives and that, if you look at the second half  
5 of my analysis, that is what I've done and, in that  
6 case, nuclear is even less attractive because it's not  
7 a very good asset to add to a portfolio of electricity  
8 resources given the current environment.

9 Q. So, how does the higher cost of nuclear power  
10 affect its marketability in terms of being able to sell  
11 that product to others?

12 A. Well, if you look at the shuddering of aging  
13 reactors, which is a new phenomenon. It's just, now,  
14 started. In the last six or seven months, we've had  
15 two online reactors operating shut-down. They have  
16 been shut down because they're uneconomic: Kewaunee  
17 and Vermont Yankee. They exist in true markets.

18 The price of electricity is set by an  
19 unadulterated wholesale market and the people who  
20 bought those reactors loved it when the prices were  
21 high but, right now, and for the foreseeable future,  
22 that was John Rowe's point about why he got out of  
23 nuclear. For the foreseeable point, the market  
24 clearing price in a true market is too low to support  
25 even aging reactors which have fully depreciated their

1 capital, although they constantly need more capital,  
2 not to mention new reactors.

3 So, in about half the country—now, each of the  
4 markets in the country, the Midwest Independent System  
5 Operator, MISO, and the New England System Operator are  
6 pure markets. They, basically, take whatever the  
7 wholesale market sets and that's the price you get and  
8 everybody gets it. So, the wind guys get it and the  
9 gas guys get it and the solar guys get it and the  
10 nuclear guys get it and, for the old nuclear reactors,  
11 it doesn't cover their costs.

12 In the other markets, they put adders on because  
13 you know what? The market clearing price of  
14 electricity is not inducing people to build more  
15 capacity and, so, now they've got these errors, but  
16 even in New York, there's pressure on some reactors  
17 that may close. I did a report of that. So, if you  
18 look at the market clearing markets in our country,  
19 nuclear can't compete. It operates at a loss if they  
20 only get the market clearing price.

21 The regulated states are, obviously, different.  
22 They don't have markets, but most public utility laws  
23 are intended that the regulator is supposed to act like  
24 it was a market. That's the goal of making sure that  
25 the captive customers get a price that looks like it

1 just is about what the market would have produced and,  
2 so, it's supposed to be least cost power, right? And,  
3 so, in all of the states with public utility  
4 regulation, that haven't put the thumb on the scale  
5 with advanced cost recovery, no one is building any  
6 nucs and the utilities have said they're not going to  
7 build nucs unless they get advanced cost recovery.

8 In North Carolina, Duke said the advanced cost you  
9 gave me wasn't sweet enough. They want more  
10 advantages.

11 So, every place, you're supposed to have at least  
12 cost power and the market is telling us where the least  
13 cost power goes and John Rowe had the misfortune of  
14 residing in the Midwest, which had this relentless  
15 wholesale price. Midwest also has a very abundant  
16 local natural resource called wind and some of the  
17 states are generating lots of wind power and what  
18 happens with wind power is the following.

19 So, at the peak hour, the grid operator says give  
20 me electricity. Here's how much I need and they  
21 dispatch electricity according to the operating cost  
22 because wind has zero operating cost. So, wind always  
23 operates. Nuclear reactors have low operating cost.  
24 They always operate and, then, the grid operator says,  
25 okay. Now, I need some gas, but the less gas you need,

1 the lower the price is because the more efficient units  
2 are dispatched first and, so, what has happened is that  
3 wind has driven down the market price of gas, of  
4 electricity, because less efficient gas plants are not  
5 called on at peak hours and the market clearing price  
6 does not yield a profit for the aging reactors,  
7 Kewaunee and Vermont Yankee. We may see some more.

8 Q. Have you looked at the resource cost—the  
9 market in Utah with respect to resource costs?

10 A. I did not look specifically at Utah. I have  
11 looked at the national numbers and, by and large, many  
12 of those resource costs, the technology costs, tend to  
13 be national. That is, the technology is available to  
14 anybody and, so, the cost of building it is going to be  
15 set by the available technology. Now, there will be  
16 site specific things, particularly in a green field  
17 site for a nuclear reactor. There's transmission line  
18 issues and big issues in Florida like that.

19 Efficiency tends to be a uniform national price--  
20 cost. You can put more insulation in walls. Build  
21 more efficient buildings and the federal level is, now,  
22 adopting appliance efficiency standards which will  
23 reduce the amount of electricity you need. That's a  
24 big push. The State of California has a big push. I'm  
25 involved in both of those efforts.

1           There's been a major increase in building code  
2 recommendation, a 30 percent reduction in the  
3 consumption of buildings and, so, appliance efficiency  
4 standards and building codes, they eat demand. They  
5 eat power plants because, once you put it in the  
6 building, people are going to set the thermostat the  
7 same place to be comfortable. They'll use much less  
8 energy both because the building shell is more  
9 efficient and the appliance is more efficient.

10           So, that is a uniform. So, the technology is  
11 uniform. Efficiency is uniform. I believe storage  
12 will be uniform as well. It's going to be a portable  
13 capacity. Some of it's going to be portable.  
14 Certainly, in New York, they're looking at portable  
15 stuff. Colorado has some proposals for some really  
16 interesting storage, solar base storage.

17           Last, then, I think nuclear comes in and storage  
18 has this really interesting property of being flexible.  
19 Nuclear, as I think we heard yesterday, is not so  
20 flexible and amping it up and down can impose all kinds  
21 of difficulties whereas well-designed storage will be  
22 easy. That will be fairly standard.

23           Natural gas prices are pretty uniform nationwide.  
24 We've got a national market. So, I believe natural  
25 gas will be uniform. So, all of those issues for those



1 types of resources ought to apply from the national  
2 level.

3 Wind and solar are more region specific. How much  
4 wind you could do in Utah. How much solar you can do  
5 in Utah. Obviously, there are richer wind resources in  
6 some places. The Midwest, Iowa, gets a lot of wind.  
7 There are richer solar resources in some places,  
8 obviously, Arizona and the southwest, but the  
9 availability of those resources could well affect how  
10 much power you need here and the wind and solar  
11 resources in Utah are not zero and whether or not they  
12 become much better choices will be a function of the  
13 technology.

14 So, as I look across the national studies, and if  
15 you look at my research, there are regional studies,  
16 the California Energy Commission. This is one of the  
17 places that Blue Castle hopes to sell power into. So,  
18 their analysis is directly relevant to the question of  
19 where Blue Castle would sell its power. The  
20 alternatives are there and the alternatives are  
21 becoming lower in cost and nuclear is not.

22 Q. We've heard testimony in this trial about  
23 nuclear power and, I think it was yesterday, this  
24 suggestion that nuclear power is good and marketable  
25 because it has a very stable price. Do you recall that

1 testimony?

2 A. Well, a stable price that's too high may or  
3 may not be a useful asset to add to your portfolio. It  
4 depends on how high it is compared to the cost and risk  
5 of the alternatives and that's exactly what I looked at  
6 in my analysis; that is, we don't know what the cost of  
7 nuclear will be today. We don't even know what design  
8 is going to be built. It's a green field site and, so,  
9 if you add an asset that is just much more costly than  
10 your alternatives, it will raise your average expected  
11 cost and I think that's where you are with nuclear  
12 today.

13 Q. So, you disagree with that?

14 A. Absolutely disagree with it. Obviously, the  
15 idea of portfolio analysis to balance cost and risk and  
16 it is simply incorrect to say, no matter how high the  
17 price is, it's a good asset to add to the portfolio,  
18 you have to do the math and, if you do the math of  
19 nuclear, today, and today means the 10 or 15 years it  
20 takes to build these things, it is not an asset to add  
21 to your portfolio.

22 Q. And do you believe that's one of the factors  
23 in, sort of—you referred to it as the end of the  
24 nuclear renaissance or the death of the nuclear  
25 renaissance, is those costs are high?

1           A. Well, there's no doubt that, if you look at  
2 the history of nuclear in America, it has never been  
3 able to deliver on its initial promise. The cost went  
4 through the roof, both times, given what they started  
5 the renaissance with.

6           Second of all, demand has always thrown a curve at  
7 nuclear. That is—here's the interesting thing. The  
8 story that demand destroyed nuclear in the 1970's is  
9 actually incorrect. If you look at the 1970's and  
10 '80's, more coal plants were built than nuclear plants  
11 were cancelled. If nuclear could have competed on  
12 price, it would have backed-out some of that coal. It  
13 couldn't compete on price and, today, it's got the same  
14 problem. Not coal, but all of the alternatives I have  
15 discussed and I think the 60-year commercial history  
16 leads to an observation about—we talked about Carnot's  
17 law yesterday. This is an observation I have reached  
18 based upon the lapse of the great bandwagon market and  
19 the failure of the nuclear renaissance in capitalist  
20 countries.

21           There's a certain inevitability about the  
22 uneconomic nature of nuclear power and here's why.  
23 Yesterday, we talked about a thumbnail of enriched  
24 uranium having this immense amount of energy and that  
25 was seen as a good thing, but that is also the curse of

1 nuclear power. There's so much energy in it that you  
2 need to build incredibly complex technologies around it  
3 to control it and extract a fraction, and that was  
4 Arnie's point, a fraction of the power. Turn it into  
5 useful energy.

6 This complex technology is very, very challenging  
7 and human nature and mother nature being what they are,  
8 no matter how you design that technology, you're going  
9 to run into beyond design events. The obvious one is  
10 Fukushima, a beyond design event. Sometimes—you heard  
11 about Brown's Ferry. A human being does something  
12 silly, drops a candle, sets a fire.

13 So, always—you've got this incredibly complex  
14 technology always being challenged by beyond design  
15 events and, so, it's never quite as safe as you thought  
16 it is and you've got to keep adding resources to it and  
17 retrofitting is very expensive. So, there's this  
18 process where nuclear safety and nuclear economics is  
19 evolving.

20 Any society that thinks it has the technical  
21 expertise, the economic wherewithal to build a safe  
22 nuclear reactor, and there are societies that think  
23 that, who also had the wherewithal, the technical  
24 expertise and the economic resources, to meet its need  
25 for electricity with less risky, less costly

1 alternatives. That's the inevitable part.

2 So, you had the nuclear renaissance where people  
3 said, oh, we're going to build a bunch of these huge  
4 reactors. I think there were 35 reactors proposed and,  
5 at the same time, you had capitalists running into wind  
6 and solar and efficiency and those costs have come down  
7 and nuclear costs have not. That's the constant  
8 challenge.

9 So, for the foreseeable future, I think nuclear is  
10 uneconomic because it's on the wrong side of that  
11 technological development. Now, they're constantly  
12 saying, well, we'll find a new technology. They never  
13 do. They never find the holy grail to solve the cost  
14 problem and I think that comes from the thumbnail of  
15 power in enriched uranium.

16 Q. You've referred, quite a bit, to the nuclear  
17 renaissance. Would you explain exactly what that is?

18 A. Well, it was a term—and if you look back at  
19 the history, and I tried to do that in my analysis in  
20 the first paper—it was coined around 2001 or 2002, the  
21 first time I can find the references to it and it was,  
22 then, fueled by some grants at the Department of Energy  
23 which asked vendors how much it would cost to build  
24 these things and MIT did a study and they came up with  
25 very low numbers, numbers that have proven to be way

1 too low, but the irony is that the MIT study, even in  
2 that study which used \$2,000.00 per kilowatt, and this  
3 is what people call overnight costs, which is what they  
4 use for nuclear, and the best way to describe overnight  
5 cost is like a barn raising. Essentially, if you could  
6 assemble all of the materials and all of the people at  
7 one point and build it overnight, not get tied-up with  
8 financing and periods, what would it cost and they call  
9 this overnight cost. It's used all the time and MIT  
10 said \$2,000 to build a nuclear reactor overnight. It  
11 might go down to \$1,000 if we get really smart. Today,  
12 we're looking at six to eight thousand. So, they just  
13 got those numbers wrong, but that was the renaissance.

14 The renaissance came out of that. Then, there  
15 were statutes passed that offered federal loan  
16 guaranties. One federal loan guaranty has been  
17 granted. It has not been signed. So, we're getting  
18 close to ten years later and we still haven't made any  
19 loan guarantees. There was decisions about expediting  
20 the process, moving the process, to make it easier to  
21 license these things. It hasn't proven to be so easy  
22 and, if you look at Vogtle and Summer, it has been a  
23 mess.

24 The fascinating thing is, for instance, one of the  
25 lessons that they said they were going to learn is that

1 we're going to have a completed design when we go into  
2 the NRC because they had complained, back in the '70's,  
3 the NRC came changing-up on us and the answer was they  
4 didn't have finished designs and, so, when the NRC  
5 looked at them and they got some [inaudible], they said  
6 this is inadequate and, so, the deal was we're going to  
7 have a design and Vogtle went to the NRC to seek its  
8 license. Revision 15 was done. Revision 16 was in the  
9 offering. We're up to 19.

10 So, they didn't quite have it done and that  
11 creates problems and, then, they start to pour concrete  
12 and Vogtle—they couldn't dig the mud out. I mean,  
13 digging the hole was a problem. There was dispute over  
14 backfill. They poured the mud mat and the mud mat was  
15 uneven and it cracked and, so, they had to fix that.  
16 Then, they put in the re-bars and they were below  
17 quality and the re-bars, in Georgia, they got the  
18 reactor off a boat and on a railroad car and the  
19 railroad car collapsed. It had been a real nightmare  
20 to try to build this new generation.

21 In addition to the fact that demand went away,  
22 alternatives became less costly and, so, we're sitting  
23 here, today, where people like John Rowe look out and  
24 they said nuclear is not in my portfolio and, frankly,  
25 the only people who have said so are people who have

1 advanced cost recovery from rate bearers and, to my  
2 knowledge, there's none of that, out here, in the west.  
3 Actually, the only place it exists is in the  
4 southeast, from North Carolina, and Florida changed its  
5 statute dramatically and, then, Levy was cancelled on  
6 the basis of the change of the statute.

7 Q. Let me have you look at a document.

8 [Inaudible discussion.]

9 THE COURT: Thank you.

10 MR. WRIGHT: What number is this?

11 MR. FLITTON: Seventy-seven, right?

12 Q. Are you familiar with the documents in front  
13 of you?

14 A. Well, this is just a list of the things that  
15 have gone wrong with the nuclear renaissance going  
16 back—I guess it goes back to 2009, I think. Where does  
17 it start? 2008, but most—things haven't gone well.  
18 That's all there is to it. I mean, all these problems  
19 and the interesting thing is that—

20 Q. Let me just stop you for a second. I just  
21 want to identify the document.

22 A. Okay.

23 Q. This has been marked as—the document you're  
24 looking at has been marked as Exhibit 77. Is this a  
25 document that you prepared?



1           A. It was prepared by me or under my direction,  
2           yes.

3           Q. Okay. Go ahead.

4           A. So, anyway, it's a list of things that have  
5           gone wrong, cost escalations and decisions not to  
6           proceed, down rates of financial status of utilities  
7           that are involved, failed efforts to—oh. I don't think  
8           I put legislation on here, but this is only in the--not  
9           the legislative environment and the interesting thing,  
10          since June, when this was written, I did a report in  
11          July on aging reactors and, looking more carefully,  
12          things had gotten really bad and there was a  
13          cancellation of some of the aging reactors that got  
14          everyone's attention. I hadn't looked at uprates  
15          before and the uprates have been cancelled, the major  
16          uprates have been cancelled.

17          So, this is a history of the road map to the  
18          failure of the nuclear renaissance, but the underlying  
19          critical factor is, again, it's this combination of  
20          extremely complex technology that proves to be too  
21          costly and alternatives that just make it impossible to  
22          sell nuclear power in market sets. If you've got a  
23          market, you're not going to be able to sell nuclear  
24          power into it.

25          Q. Okay. I noticed that this summary that you

1 have on the sheet ends in June of 2013. Is that right?

2 A. Yes.

3 Q. Okay. Have there been additional things that  
4 would go on this list since then?

5 A. Well, I think, Levy was cancelled subsequent  
6 to this because this ends, roughly, when Florida  
7 changed its advance cost recovery statute. Subsequent  
8 to that, the Levy reactor, they said they would not go  
9 ahead and that has created a big cost proceeding.

10 Vermont Yankee was closed—or, Entergy declared its  
11 intention to close Vermont Yankee and, prior to that,  
12 Entergy had said they were going to re-organize their  
13 nuclear division. They're not making any money on  
14 nuclear power, even with the old ones. Entergy has no  
15 plans to build a new one. They're not making any money  
16 on the old ones and, so, they have re-organized and,  
17 then, Vermont Yankee is an interesting example for Utah  
18 to think about, right?

19 Because there was a lot of opposition to Vermont  
20 Yankee in Vermont, but they had a lot of trouble  
21 asserting state jurisdiction over that. The  
22 Legislature passed a law that said we shouldn't pay for  
23 it. It wasn't clear they were going to do that.  
24 Entergy finally said they gave up the ghost for  
25 economic reasons. So, cancelling Levy and shutting

1 Vermont Yankee are two really big events, after this,  
2 that if you look at the articles, a lot of people, now,  
3 understand the renaissance never was and it's gone.

4 Q. You've heard testimony, yesterday I think,  
5 about this optionality or this idea of optionality that  
6 Blue Castle has talked about. What is your view of  
7 that?

8 A. Well, I laid-out the key questions here.  
9 Options have costs and they need to be executable to be  
10 meaningful and they tend to have termination dates, if  
11 you look at financial options.

12 So, there will be a moment where the person who is  
13 owning the assets says, well, you've got to make-up  
14 your mind and, so, if you look at those things—so, the  
15 key question, here, as I understand it, is the  
16 opportunity cost of Blue Castle is going to be  
17 alternative uses of that resource will not attract  
18 investment. Why would you invest if you're dependent  
19 upon that resource if Blue Castle can wake up one  
20 morning and say I want it now. So, all of your  
21 investment in whatever you've decided to do to use that  
22 resource is, now, useless because they pulled the  
23 resource back.

24 So, there's an opportunity cost of tying-up that  
25 resource and scaring away alternatives. You have to

1 factor that in.

2 The second thing I would factor in is can you  
3 execute it and I don't think you can. So, it's an  
4 option without real value because I don't see the  
5 economics any time soon. Now, 50 years—50 years is an  
6 awfully long time to claim that you can use that  
7 resource. So, this is not, in my opinion, an option  
8 you should buy and pay for with water, which is what is  
9 going on here. That's the cost of this option and, as  
10 I read the statute, that is an issue that this Court  
11 needs to address.

12 Q. Do you believe that Blue Castle's model of  
13 going through this permitting process and, then,  
14 bringing in investors, down the road, to build this  
15 plant is a viable model?

16 A. Well, look. To my mind, that's, purely,  
17 speculation. The amount of money they have raised is  
18 miniscule compared to if we're talking about two  
19 reactor units, a green field site. Let's just use the  
20 AP1000's. The lowest number we're looking at is 14, 15  
21 billion and those are brown field sites. The lead  
22 reactor was a green field site and they were pushing 22  
23 to 24 billion. So, they raised miniscule percentage of  
24 the cost. There's no financing there. This entity  
25 could not possibly execute that project.

1           So, now, they say, well, someone will come along  
2 and fund it. Well, who? Fund it? Who? In my view,  
3 utilities aren't doing it unless they can shift all the  
4 risk to rate payers and that doesn't happen out west.  
5 It hasn't happened any place except in the southeast  
6 and, so, the statement that, well, this project is  
7 financially—can be run not by these guys and by who?  
8 They don't know who and I don't think there's any  
9 people coming forward. So, from my point of view, it's  
10 irrelevant that they say it's an option and the project  
11 to be executed, that's the amount.

12           The state—so, can they get a license? That's not  
13 a project. The license doesn't actually use the water.  
14 The nuclear reactor is the project that would use the  
15 water. We don't know what they'll do. We don't know  
16 who will do it. We don't know how they will finance  
17 it. We don't know how much it will cost, right? And,  
18 so, there's no their, there, to saying, hey. This is  
19 just an option, but the option is about using water and  
20 the site license does not use water.

21           Q. So, let me just ask you, again, a couple of  
22 questions. First, do you believe that this project is  
23 economically feasible?

24           A. For the reasons I've stated, it is infeasible  
25 because it cannot sell power into markets. It can't

1 compete with the alternatives.

2 Q. Okay and do you believe that the project or  
3 the project sponsors had the financial ability to  
4 complete the project?

5 A. Blue Castle does not have anywhere near, a  
6 faintest hint of the resources to build a 15 to 20  
7 billion dollar project.

8 Q. Okay. What about bringing others in? For  
9 example, what about financing? Is there financing  
10 available?

11 A. Well, the history of the financing is it's  
12 very difficult. I spent, actually, a significant  
13 amount of time watching people get out. So, the public  
14 power folks have gotten out. San Antonio pulled out of  
15 the south project and went away. Levy could never find  
16 public power folks. In summer, in South Carolina,  
17 Santee Cooper wants to get out. So, people are running  
18 away, not charging in to fund this stuff and those  
19 entities, public power entities, have special taxing  
20 authorities. They're not normal, typical capital  
21 enterprises. So, they can tax their citizens. So,  
22 everybody else is running away. No one is running in.

23 So, the claim that the utilities will come  
24 charging in doesn't ring true. There's no evidence to  
25 support that suggestion.

1 MR. FLITTON: That's all I have. Thank you.

2 THE COURT: Thank you, Mr. Flitton. Cross-  
3 examination, Mr. Wright?

4 MR. WRIGHT: Yes, Your Honor.

5 CROSS-EXAMINATION

6 BY MR. WRIGHT:

7 Q. Dr. Cooper, you are—tell me the title, again,  
8 at the Vermont Law School?

9 A. Senior Fellow for Economic Analysis.

10 Q. Not on the faculty?

11 A. No. I'm just a fellow at the Institute for  
12 Energy and Environment.

13 Q. You mentioned Arnie. You're referring to  
14 Arnold Gundersen?

15 A. Gundersen, yeah.

16 Q. Friend of yours?

17 A. We first met in the Levy case in 2009 in  
18 Florida. That was the first time I knew him.

19 Q. He said he was from Vermont. Are you from  
20 Vermont also? Is that where—

21 A. No. I'm resident in Washington—Silver Spring,  
22 Maryland.

23 Q. You live in Maryland?

24 A. Yes.

25 Q. You're a research guy at the Vermont Law

1 School?

2 A. Yes. I do research there. I give a lecture  
3 there a couple times a year and, you know, I'm a fellow  
4 at a number of universities in specific subjects that  
5 are institutes that deal with the subject matter that  
6 I'm interested in.

7 Q. Okay. What is the United States Congress  
8 going to do in this country concerning greenhouse gas  
9 emissions?

10 MS. SWENSEN: Objection. Calls for speculation.

11 THE COURT: I think it's his area of expertise.  
12 At least ask if he know about that.

13 A. Well, the closest thing that Congress came to  
14 doing something about greenhouse gas was the passage of  
15 the Waxman-Markey Bill.

16 Q. No. My question to you is different. My  
17 question to you is what is it going to do, say, in the  
18 next 10, 15, 20 years?

19 A. That is unclear, uncertain. I think what the  
20 administration is going to do is clear, however.

21 Q. Which is?

22 A. Which is we have an aggressive policy for  
23 efficiency.

24 Q. Is that all?

25 A. In buildings. We have an aggressive policy to



1 control emissions from coal-fired plants which may have  
2 the effect of stimulating carbon capture and storage.

3 Q. Which is expensive?

4 A. Well, the ironic thing is that the costs of  
5 nuclear have risen so much that carbon capture and  
6 nuclear may be competitors out in the distant future.  
7 We'll see. If you look at the numbers that people are,  
8 now, writing down, they've gotten awfully close, which  
9 is stunning given where we started in the renaissance.

10 Q. Carbon capture and storage is not happening  
11 now?

12 A. It's not happening now.

13 Q. It's not a technology that anybody is  
14 deploying?

15 A. Not at the scale. Obviously, oil folks use  
16 some carbon capture and storage and people are looking  
17 at how to scale that.

18 Q. I'm talking about on a major scale.

19 A. They haven't done it on the utilities scale,  
20 no. Frankly, nuclear is only being deployed in the two  
21 places that I mentioned.

22 Q. You were here for yesterday's part of the  
23 trial?

24 A. Part of it, yeah.

25 Q. Part of it. You weren't here for Monday,

1 Tuesday?

2 A. No. I, obviously, had accounts given to me,  
3 but I was not physically present.

4 Q. What analysis have you done concerning Utah's  
5 wind power resources?

6 A. I have not looked, a great deal, at wind power  
7 resources in Utah.

8 Q. If I could represent to you that, in this  
9 case, it has been established, without dispute, that  
10 Utah has very little, relatively little in the way of  
11 wind resources, do you have a reason to dispute that?

12 A. No. I don't have a reason to doubt that.

13 Q. What have you done in connection with Utah's  
14 solar resources or development?

15 A. I haven't done that analysis.

16 Q. You talked about storing electricity.

17 A. Yes.

18 Q. Where is that happening? I'm talking about a  
19 scale, now, not the-

20 A. Well, the interesting thing is, on the day  
21 that I released my report on aging reactors, and why  
22 the economics of nuclear have become bad enough to  
23 cancel-need to cause abandonment of those reactors,  
24 early retirements, there was an article about Con  
25 Edison in New York which is rolling out major pilot

1 projects for next year to do utility scale storage.  
2 There are proposals I know of in Colorado to use solar  
3 power to do utility scale storage projects. So-

4 Q. Proposals?

5 A. I believe they've been offered under  
6 Colorado's statute to encourage that stuff and-

7 Q. Let me stop you there. Colorado statute. So,  
8 the Colorado Legislature has enacted some sort of-

9 A. Has enacted a statute to give an incentive to  
10 these alternatives. Of course, the simple fact of the  
11 matter is that utilities in the rest of the country  
12 will gain an advantage if the Colorado stuff works or  
13 the New York stuff works, I mean, since the  
14 technologies tend to be generalized and become  
15 available.

16 Q. So, future deployment of a technology can  
17 learn from ongoing deployment of that technology,  
18 learning curve, right?

19 A. It can. The problem is that—and I looked at  
20 this in my second report. Nuclear has not exhibited a  
21 learning curve.

22 Q. So, the nuclear industry just doesn't get it,  
23 but everybody—

24 A. No. It's not a question of getting it and  
25 that's why I described the inherent problem. See? I'm

1 not an anti-nuclear guy. The technology has a  
2 fundamental problem in terms of its complexity and,  
3 now, we've been through two cycles and it has not  
4 exhibited the declining cost of learning. It has not.  
5 That's a historical fact and the reason is not—it's  
6 not that you just don't get it. Nuclear engineers,  
7 nuclear utilities, are honest, hardworking people who  
8 would like to make it work. They haven't been able to  
9 and that's why a guy like John Rowe, the CEO of the  
10 biggest nuclear utility in the country, says it's not  
11 in my portfolio.

12 Q. What has the Utah Legislature done in  
13 connection with nuclear power?

14 A. As I understand it, there's been an expression  
15 for alternatives. I don't know that there's direct  
16 incentives been offered.

17 Q. I'm not talking about incentives. Are you  
18 aware of any Utah legislation or resolutions concerning  
19 nuclear energy?

20 A. I'm not aware of resolutions.

21 Q. Do you know how dependent Utah is on fossil  
22 fuels?

23 A. I don't know. I suspect it has a significant  
24 dependence on fossil fuels.

25 Q. If I told you north of ninety-five percent,

1 would you have a reason to disagree with that?

2 A. I wouldn't have a reason to disagree with  
3 that.

4 Q. Would you consider that to be a sound energy  
5 portfolio?

6 A. No. I would like to diversity that portfolio  
7 as quickly as I could.

8 Q. And you would do that with wind and solar?

9 A. Well, I would start with efficiency and-

10 Q. That's the new buildings with the better  
11 insulation?

12 A. Well, it's about utility efficiency programs  
13 that incent and there have been some very successful.  
14 You know, people look at California. It turns out that  
15 there are six other states that have achieved  
16 California's outcome of, essentially, zero per capita  
17 demand growth. So, there's lots of examples of ways to  
18 use efficiency, both incentive programs, utility  
19 programs and building codes, to use efficiency to buy  
20 more time to learn about these other technologies.

21 Q. And the expense you're talking about to buy  
22 this time is do we tear-down the inefficient buildings  
23 and build the new ones?

24 A. Not at all. Obviously, the utility programs,  
25 the weatherization programs, deliver electricity that,

1 at a cost, they save electricity between two and six  
2 cents per kilowatt hour.

3 Q. How do they do that?

4 A. They do that by adding technology that costs  
5 less than the cost of energy saved.

6 Q. Such as?

7 A. Such as insulation. Such as double-glazing.

8 Such as—

9 Q. Double-glazing? What does that mean?

10 A. More glass to reduce loss, tightening building  
11 shelves.

12 Q. Are you talking about retrofitting?

13 A. You can retrofit and the cost is very low.

14 Q. Who pays for that?

15 A. Well, there are lots of places where utilities  
16 provide incentives for that because the cost of  
17 reducing consumption is less than the cost of buying  
18 energy and, so, there's a game, there, that is shared  
19 between the customer and the utility.

20 Q. Do you think the people of Utah and the  
21 industries in Utah are not trying to be more efficient  
22 with their energy use?

23 A. Well, maybe they are, but they're not trying  
24 hard enough and that's if you look at building nucs at  
25 12, 15 cents, there's an immense amount of stuff you

1 can do that's less than that and there are some  
2 barriers to why they would not do it. Sometimes, the  
3 landlords want to get the cheapest first cost.  
4 Consumers don't do the right—there's all kinds of  
5 reasons that's not happening.

6 Q. Where are they—

7 A. Well, as I said—

8 Q. —on a level that Utah is not?

9 A. Well, as I said, there are six states:  
10 California, Wisconsin, Vermont off the top of my head.  
11 I forget the others—that have achieved a much lower  
12 rate of demand growth for electricity than the rest of  
13 the country.

14 Q. How much lower?

15 A. Twenty, thirty percent.

16 Q. And Utahans, are just not getting it out here?

17 A. You haven't tried yet. You didn't think—and  
18 that's the same thing with storage. We spent all this  
19 time because we thought we had lots of cheap resources.  
20 Now, we discovered we don't, for economic and  
21 environmental reasons and, now, we're starting to try  
22 to develop new technologies. That's what the storage  
23 is about. That's what the declining cost of wind is  
24 about and that's what the efficiency programs are  
25 about. So, it's not that you didn't get it, you didn't

1 have to try to get it and, now, this is a big moment  
2 for people to start thinking about new ways to keep the  
3 lights on.

4 Q. You testified that the real options approach  
5 allows you to—by keeping options open, allows you to  
6 learn, as time moves on—

7 A. Yes. Yes.

8 Q. —and, then, select from the options as you  
9 gather more information?

10 A. Yes.

11 Q. Have I said that, basically, right?

12 A. Yes.

13 Q. And it allows you to make better decisions  
14 because you've got more information.

15 A. The question is, if more information can lead  
16 you to make better decisions, and the cost of the  
17 option is less than the amount that you will improve  
18 your decision, then, you ought to keep the option open.

19 Q. Okay and you say the options have cost.

20 A. Yes.

21 Q. And I wrote it down so that I wouldn't forget.  
22 You said that, in this case, in the Blue Castle  
23 approach, that options are, quote, being paid for with  
24 water.

25 A. Well, as I understand it, this Court case is



1 about a right to water.

2 Q. Yes, it is.

3 A. And the right to use the water will be held by  
4 Blue Castle.

5 Q. Yes.

6 A. Now, they won't actually use that water for an  
7 awfully long time. If they hadn't built the reactors  
8 and it takes a long time and they haven't figured out  
9 which reactor they're going to build yet. So, it will  
10 be a while, but once you have that right, if I'm  
11 someone else and say I would use that water, but I need  
12 to make these investments, and if I have to invest in  
13 finding a way to use that water, and you can wake up  
14 tomorrow morning and say I'm taking it now, you have  
15 rendered my investment useless and, so, the opportunity  
16 cost of this option, as you call it, is that you will  
17 scare away the alternatives.

18 That's the first answer, but there's a second  
19 answer that, I think—and my lawyers have made me read  
20 the statute and I read the statute, is that the Court  
21 has to decide about projects, not options, and the  
22 option you have is not a project. It's a right without  
23 a reality.

24 Q. Is that how you understand the Blue Castle  
25 project?

1           A. I understand—well, if you tell me this is an  
2 option to buy an ESP, to achieve an ESP, the ESP is not  
3 a nuclear reactor.

4           Q. That's right.

5           A. Okay? And, so, the project is a nuclear  
6 reactor.

7           Q. I need to stop you and get back to the  
8 question. What I want to understand is why you think  
9 that this option is being paid for with water?

10          A. Well, I've explained exactly why.

11          Q. Okay. So, don't we don't have to re-plow the  
12 ground, it's your opinion or your understanding that  
13 because this application could be granted, that that  
14 water cannot be used by anyone else?

15          A. No. I didn't say it cannot. I said a person  
16 who is thinking about a using that water, and has to  
17 make a capital investment to make it useful, and all  
18 resources tend to be useless until we've added capital  
19 to them.

20          Q. Who is this person thinking about using this  
21 water?

22          A. Everybody else.

23          Q. Is that your understanding?

24          A. Anybody else.

25          Q. Hold on. Is that your understanding of how

1 you apply for the use of water in the State of Utah?

2 A. If you have a project. You come forward with  
3 a project--

4 Q. Exactly.

5 A. -but a project is the actual use of the water  
6 and, so, if I want to come forward with a project and  
7 say here's how I would use that water and, then, this  
8 Court will decide if it's economically feasible,  
9 physically feasible, in the public interest and  
10 financeable, as I understand the four criteria, that  
11 project would, then, come to the State Engineer, first  
12 and, if there's a dispute to this Court, they know  
13 about it and decide that it meets the four standards.  
14 What I'm telling you is that, once you lay claim to  
15 that resource, people who might think about that are  
16 scared away. So, there's a cost to that option, but  
17 the second point is that an ESP is not a project.

18 Q. Were you here for Kent Jones' testimony?

19 A. I was not.

20 Q. He's the Utah State Engineer?

21 A. I was not. I was here yesterday and it seems  
22 to me--

23 Q. You've answered my question. I just simply  
24 wanted to know if you were here for Kent Jones'  
25 testimony.

1 A. I was not.

2 Q. In terms of actual money out the door, writing  
3 checks, who is paying the costs for the options that  
4 Blue Castle is describing?

5 A. The effort to get an ESP?

6 Q. Yes.

7 A. I assume there are investors behind it who  
8 have put up their capital.

9 Q. Well, Blue Castle is the one writing the  
10 checks.

11 A. Okay.

12 Q. The rate payers of Utah are not at risk here.  
13 You understand that?

14 A. The rate payers? Well, the rate payers of  
15 Utah will be at risk if the project is executed. Well,  
16 it might be. It depends on how you're going to get  
17 utility finance and, again, you need to build this  
18 project, in my opinion, in order to get the rights.  
19 So, at the end of the line, you said you were going to  
20 find investors, if those investors are utilities who  
21 want to rate base this reactor or reactors, then, rate  
22 payers will be at risk.

23 Q. Let's see if we can agree on some facts. Utah  
24 is the third fastest growing state in the country.  
25 Would you agree with that?

1 A. I don't dispute it.

2 Q. In fact, as a result of the 2010 census, we  
3 got a fourth seat in the House of Representatives. Are  
4 you aware of that?

5 A. I have no reason to doubt that.

6 Q. People in Utah like to use electricity just  
7 like the people in Vermont or Maryland, where you live?

8 A. Certainly.

9 Q. The price of natural gas is subject to market  
10 fluctuation?

11 A. The price of natural gas is subject to market  
12 fluctuations.

13 Q. Where it's going to be in 10, 15, 20 years, no  
14 one knows?

15 A. People make projections based upon history.

16 Q. Sure. Where it's going to be in 10, 15, 20  
17 years, no one knows.

18 A. No one knows. The fundamentals suggest it's  
19 not—it's going to be fairly inexpensive.

20 Q. Well, but we've already established we don't  
21 know what the United States Congress is going to do  
22 about that, do we?

23 A. About the price of natural gas?

24 Q. About the emissions that natural gas lets off?

25 A. We don't know. Natural gas, obviously, is

1 preferable to coal.

2 Q. What are the reasons, in your opinion, for the  
3 current low prices of natural gas?

4 A. Technological revolution that has dramatically  
5 improved the reserve to consumption ratio.

6 Q. What is that technological revolution?

7 A. The Sterling revolution.

8 Q. And otherwise known as?

9 A. Well, it's hydraulic drilling. You can call  
10 it fracking.

11 Q. Yes.

12 A. It's a revolution that's just begun.

13 Q. Fracking comes with certain costs.

14 A. There are. The debate of environmental cost  
15 is ongoing.

16 Q. Certain risks?

17 A. Certain risks.

18 Q. Not sure whether it will continue indefinitely  
19 into the future.

20 A. You have no better knowledge of that than I  
21 have about my carbon—about the carbon future.

22 Q. That's right. Exactly.

23 A. One thing that will—I will suggest one thing  
24 is that the fracking revolution will spread globally  
25 and increase the supply of—

1 Q. Will spread?

2 A. I think it will. It's a compelling  
3 technology. There are resources around the world that  
4 it could be exploited by and it could, in fact, have a  
5 big impact on the global supply of fuels.

6 Q. You're certain of this?

7 A. I didn't say I'm certain. I said that is as  
8 likely as the other things we've speculated on.

9 Q. Well, I'm not the one speculating. I'm asking  
10 you about how far into the future we can do that with  
11 any degree of certainty.

12 A. Well, you've asked me to speculate about  
13 carbon. You've asked me to speculate about--

14 Q. No. No. No. I didn't ask you to speculate.  
15 What I asked--

16 A. You asked what Congress would do.

17 Q. What I asked you is--the point of the question,  
18 as you obviously know, you've got a Yale Ph.D., is we  
19 don't know, do we?

20 A. We don't know what nuclear reactor will cost,  
21 either.

22 Q. That's right.

23 A. We don't know how long they will last. We  
24 don't know what the load factors will be either. One-  
25 fifth of reactors built in this country were--

1 THE COURT: Just try to focus on the question  
2 that's asked.

3 A. Okay. Well—

4 THE COURT: We understand what you're saying, but  
5 he's [inaudible]

6 A. Okay. Fine. So, we don't know lots of things  
7 and we do analyses to try and figure out the likelihood  
8 of what's going to happen.

9 Q. Regardless of whether it's a 1950's notion,  
10 nuclear power is a base load source of power in this  
11 country, is it not?

12 A. It is a base load source of power.

13 Q. Wind is not there yet.

14 A. Wind is not there yet.

15 Q. Solar is not there yet.

16 A. Solar is not there yet.

17 Q. Storage of electricity in a battery is not  
18 there yet.

19 A. Storage is not there yet. Efficiency is base  
20 load.

21 Q. You are optimistic about wind, solar, storage,  
22 efficiency?

23 A. I am realistic. If I look at the historical  
24 curves, and I've provided them, of the cost of those  
25 technologies, they are either dramatically declining or



1 very low.

2 Q. But pessimistic about nuclear?

3 A. If you look at the history of the cost of  
4 nuclear, you have got to be pessimistic.

5 Q. What is the history of wind, solar and  
6 efficiency that causes you to be so optimistic that  
7 it's going to solve the problems while nuclear can't?

8 A. If you look at the 20 year cost trends, their  
9 costs are coming down. They are being relied upon for  
10 larger and larger percentages.

11 Q. I'm talking—now, let's stop so we're talking  
12 about the same thing. I'm talking about major  
13 deployment of wind and solar power on such a level that  
14 I can walk to a light socket, flip the switch and be  
15 sure that the light is going to come on.

16 A. Frankly, no single source is necessary to  
17 ensure the light will come on.

18 Q. No single source?

19 A. The lights will come on because, look. If my  
20 efficiency plays out, I don't need that much resource.  
21 If my storage comes on, I don't need that much  
22 resource.

23 Q. You're in efficiency.

24 A. Yes.

25 Q. Let's talk about this building shell thing and

1 insulation and—how is that going to be implemented?  
2 What hammer of legislation is going to have to come  
3 down in order to make sure that buildings are re-  
4 insulated and thermostats are set at a certain level  
5 and—

6 A. No. No. I didn't say—

7 Q. Let me finish. Let me finish—and we burn a  
8 certain kind of light bulb. When is that going to  
9 happen?

10 A. Well, let's be clear. Some of it happens in  
11 the marketplace. First of all, I didn't tell you to  
12 turn the thermostat down. I exactly said the opposite.  
13 I said you can leave your thermostat where it is and  
14 you'll use fifty percent less electricity in that new  
15 building with the new air conditioner and that's a  
16 power plant I won't need.

17 So, when will it happen? We have, in fact,  
18 mandated the production of high efficiency light bulbs.  
19 We are in the process, and we have mandated, the  
20 production of much more efficient appliances in the  
21 State of California, one of the largest—

22 Q. Aren't we talking about—

23 A. No. You asked me the hammer. Here are the  
24 hammers. Here are the hammers. We've mandated light  
25 bulbs. We've mandated appliances. We are—the building

1 codes have been adopted. Now, they need to spread to  
2 the localities, but the code exists for the thirty  
3 percent improvement and, so, those are hammers.

4 There's a lot of economic sense that drives those  
5 hammers and, so, the people who build and operate those  
6 things are looking at 15 cent power from a nuclear  
7 reactor and they can get five cent power from a better  
8 building shell, that will have an impact as well.

9 So, there's not only a legislative hammer, there's  
10 also an economic hammer and, of course, the biggest  
11 economic hammer that has pounded nuclear is the price  
12 of natural gas.

13 Q. Which is currently low?

14 A. Which is at historic levels, actually.

15 Q. Hasn't always been low.

16 A. It has more often been low than not.

17 Q. And we don't know where it's going in the  
18 future.

19 A. You don't know it's going up.

20 Q. That's right.

21 A. That's right.

22 Q. Just like you don't know it's going to stay  
23 down.

24 A. And history tells me this is where it is given  
25 reserve to production ratios.

1 Q. And if somebody wants to engage in fracking in  
2 your backyard, are you going to have something to say  
3 about it?

4 A. I do economics. I'm here as an economic  
5 expert and I do economics.

6 Q. You get the point, don't you?

7 A. Well, the question is—

8 Q. Fracking is fine in someone else's backyard.

9 MS. SWENSEN: Objection. Argumentative.

10 THE COURT: It is argumentative. Let's go—

11 A. The simple fact. You have no idea how much—

12 THE COURT: Doctor?

13 A. Okay. Go ahead.

14 THE COURT: Go ahead and ask your next question.

15 Thank you, Sir.

16 Q. Arizona also a fast growing state? We can  
17 agree on that?

18 A. Yeah.

19 Q. Nevada? Same?

20 A. Nevada, I think, has suffered a bit of a set-  
21 back lately, but I haven't looked at the numbers.

22 Q. According to the 2010 census.

23 A. Yeah. 2010 was soon after the financial melt-  
24 down. So, we'll see in the 2020 census. Things may  
25 change a little.

1 Q. Currently ranked among the highest, fastest  
2 growing states, right?

3 A. Okay, fine. Yes. Yep.

4 Q. You understand those states are in this BCH,  
5 Blue Castle's, target market for electricity.

6 A. I thought California was also.

7 Q. Possibly.

8 A. Yeah and California is a great big market.

9 Q. Yes.

10 A. And California has a very aggressive program  
11 to reduce its demand.

12 Q. California doesn't like nuclear much, does it?

13 A. Well, they have some reactors and they had one  
14 that broke and was very expensive and it has been shut  
15 down.

16 MR. WRIGHT: Your Honor, I would like to take a  
17 recess to evaluate where I need to go further on this  
18 cross. May I do that?

19 THE COURT: Do you have any objection?

20 MR. FLITTON: No.

21 THE COURT: Let's take a few minutes. Dr. Cooper,  
22 I'll have you come back at five minutes before 10:00.

23 MR. WRIGHT: Can I have straight-up until 10:00?

24 THE COURT: Yeah, let's do that. Let's just take  
25 a break until 10:00.

1 MR. WRIGHT: Thank you.

2 [Recess.]

3 THE COURT: Please be seated. We're back on the  
4 record in Case 1207009, Heal Utah v. Kane County.  
5 Counsel are all present. Dr. Mark Cooper is on the  
6 stand.

7 CROSS-EXAMINATION OF DR. COOPER CONTINUED

8 BY MR. WRIGHT:

9 Q. Dr. Cooper, what are the sources of thermal  
10 power in this country?

11 A. Well, gas, coal, nuclear are the big ones.  
12 You might consider geothermal. You could consider  
13 biomass as well. That would be thermal.

14 Q. And of the three biggies, let's say gas, coal  
15 and nuclear, we can agree those are the three biggies,  
16 right?

17 A. They account for the majority.

18 Q. Of those three, where does nuclear rank in  
19 terms of production costs?

20 A. Well, the total cost of building a new  
21 nuclear-

22 Q. No. No. That's not what I asked.

23 A. You just want the operating cost?

24 Q. Yes.

25 A. It's, probably, in the two cent range, two to

1 three cents.

2 Q. Well, and compared to gas and coal?

3 A. Gas and coal are, probably, as operating  
4 costs, twice that.

5 Q. You talked about the Levy plant. That's a  
6 reactor in Florida or a project in Florida?

7 A. It was a project—an AP1000 two-unit reactor on  
8 a green field site.

9 Q. You mentioned that the project was cancelled?

10 A. The project was cancelled. The contract was  
11 abandoned.

12 Q. That's the EPC contract?

13 A. EPC contract.

14 Q. And do you know why that was done? Why that  
15 was cancelled?

16 A. The utilities said they didn't like the change  
17 in the law, I believe they said at that time.

18 Q. Did the utility also say it thought it could  
19 get a better deal under the EPC contract?

20 A. I am not aware of what the EPC contracts—they  
21 have been shrouded in total secrecy.

22 Q. Total secrecy?

23 A. I mean, they're not—they're confidential and I  
24 have not read any EPC contracts.

25 Q. Do you have any idea as to whether that EPC

1 agreement is being re-negotiated?

2 A. I do not know.

3 Q. Do you know whether the levy project is  
4 continuing to work on its site development?

5 A. I believe they're not recovering any costs  
6 from rate payers anymore.

7 Q. No.

8 A. I do not know if the utility decided to  
9 continue work on the site, no.

10 Q. Do you know whether the utility has spent any  
11 money in connection with its site work and to continue  
12 to pursue that license?

13 A. I do not know.

14 Q. Exelon, you talked about that and what was the  
15 fellow's name?

16 A. John Rowe.

17 Q. He is the CEO?

18 A. Former CEO.

19 Q. And Exelon already has a significant nuclear  
20 portion of its portfolio, doesn't it?

21 A. It's the largest nuclear utility in the  
22 country, I believe.

23 Q. So, what Exelon has decided to do, at this  
24 point, is to not add to an existing large nuclear  
25 portfolio?



1 A. And has cancelled its uprights as well, yes.

2 Q. You were not asked about it on direct  
3 examination.

4 MR. WRIGHT: The exhibit thing is a little weird.  
5 Do you guys have a witness copy of this?

6 [Inaudible discussion.]

7 Q. Dr. Cooper, you've been handed what's been  
8 marked as Exhibit 82. It's a document I suspect you  
9 recognize?

10 A. Yes.

11 Q. What is it?

12 A. It's the levelized cost estimates for  
13 [inaudible] Resources and it has--

14 Q. Did you prepare this?

15 A. I did.

16 Q. Yourself, personally?

17 A. Yes.

18 Q. Would you characterize some of the work or the  
19 analysis that you've done as a kind of statistical  
20 analysis?

21 A. Some of it, the multi-criteria portfolio  
22 analysis is statistical, yes.

23 Q. It's one of you guys'--

24 A. Yes.

25 Q. In terms of statistical analysis, what is an

1 outlier?

2 A. An outlier is a case that's far from the mean.

3 Q. The mean meaning—

4 A. The mean or the medium. You could do the mean  
5 or the medium and an outlier is far away, yes.

6 Q. On this—I'm sorry, I forgot the number.

7 Eighty-two? Exhibit 82? You have a number of sources  
8 that you have looked at to compare on your levelized  
9 cost estimate, correct?

10 A. Yes.

11 Q. And you have one source that is the California  
12 Energy Commission, correct?

13 A. Yes.

14 Q. And that source is identified on the graph in  
15 the black lines?

16 A. Yes.

17 Q. The California Energy Commission data is,  
18 would you agree, significantly higher than the other  
19 sources you've identified on your graph?

20 A. Well, it's significantly higher, but it's  
21 higher across all of the resources.

22 Q. Okay.

23 A. So, yes. It's higher than the others, but  
24 internally, it's more consistent with itself than it  
25 appears.

1 Q. And just so we're clear, if you look at it  
2 closely, what you have on the CEC data, say, for  
3 nuclear, which is on the far right—

4 A. Yes.

5 Q. -of the chart, of the graph, you have three  
6 lines. Am I right?

7 A. I believe there are three lines, yes.

8 Q. You have a low—

9 A. A high and a medium. Low, medium—well,  
10 actually, it's not a medium. So, the way the  
11 California Energy Commission, they do a high and a low  
12 and, then, they do a base case and the base case is not  
13 always the average or the midpoint. So, they have a  
14 case that they see as base and, then, they have a high  
15 and a low and—okay. So, that's—

16 Q. Okay. So, what you did, in developing this  
17 data and selecting your data is from the CEC source.  
18 You took three data points for nuclear, correct?

19 A. I took all the three data points for all the  
20 resources.

21 Q. Okay, from all the resources?

22 A. Well, from California, gives me a high base  
23 case and a low for all the resources.

24 Q. The others don't have the same—

25 A. Some of them have highs and lows. Some of

1 them—

2 Q. Yes. Some of them have two.

3 A. Some of them have two.

4 Q. None of the others have three?

5 MS. SWENSEN: Objection. Mischaracterizes the  
6 exhibit.

7 A. That may be the case—I didn't---

8 THE COURT: Just wait one second. We have an  
9 objection, Doctor. Go ahead.

10 MS. SWENSEN: Objection. Mischaracterizes the  
11 exhibit.

12 MR. WRIGHT: We haven't characterized it yet.

13 THE COURT: I think he's trying to sort that out.

14 MR. FLITTON: Well, no. He said that none of the  
15 others have three lines and that's not correct.

16 MR. WRIGHT: Well, he gets to answer that.

17 THE COURT: Yeah, I think it, actually, was a  
18 question rather than a statement, at least that's what—  
19 and I think Dr. Cooper will have a chance to answer it.

20 A. Yeah. So—

21 THE COURT: Go ahead, Dr. Cooper.

22 A. Most of them have two.

23 Q. Now, just so we understand how this graph  
24 works, your CEC data, you've written numbers at the  
25 top.

1           A. Yeah because they're high, in the extreme  
2 case, yes.

3           Q. They're off the chart, in effect?

4           A. Yes. They're high in the trunk. Those are  
5 truncated. So, you can see the others clearly.

6           Q. Right. These numbers should represent the  
7 values. You have these lines [inaudible]

8           A. Yes. Yes.

9           Q. Okay.

10          MR. WRIGHT: One moment, Your Honor.

11          THE COURT: Take your time.

12          [Inaudible discussion.]

13          MR. WRIGHT: Nothing further, Your Honor.

14          MS. VALDES: I have no questions to ask.

15          THE COURT: No questions? Thank you, Ms. Valdes.

16          Re-direct, Mr. Flitton?

17          MR. FLITTON: Yes, thank you.

18          RE-DIRECT EXAMINATION

19          BY MR. FLITTON:

20          Q. Before we start, just to clear up the record,  
21 let me go back to this chart and can you see this okay?

22          A. I can see it. I have a copy here, too.

23          Q. All right. So, you were asked the question  
24 how many of these different power sources have had  
25 three points on them from the CEC, correct?

1 A. Yes.

2 Q. Okay. So, how many does offshore wind have?

3 A. No. I thought the question was about the  
4 source; that is, the authorship. So, the California  
5 Energy Commission gives me three estimates. Lizard  
6 gives me two. EIA gives me—actually, EIA gives me  
7 three. They do have a high and a low in the back. You  
8 can find it. So, he was asking me by the source.  
9 You're asking me by the resource.

10 Q. That's correct.

11 A. Okay? And, so—

12 Q. And I'm focusing on the CEC numbers.

13 A. Well, the CEC gives me one, two, three, four,  
14 five, six, seven resources.

15 Q. Okay, but how many points on here? I'm  
16 talking about low, medium, high.

17 A. Three points from the CEC and onshore wind,  
18 probably, has seven or eight across the studies, but—  
19 well, so, across the studies, as I said, the CEC tends  
20 to be high. Across the studies, there's an internal  
21 consistency. So, if you're lower on onshore wind, they  
22 tend to be lower on the other, internally consistent  
23 within that study and some of that variation comes due  
24 to the assumptions used in calculating the levelized  
25 costs. So, someone might use a higher interest rate

1 and that will drive the prices higher. Someone might  
2 use a different plant life and that will have an effect  
3 on the cost.

4 So, it's important, when you look at this, to  
5 understand that, internally, they are consistent.  
6 Between studies, they reflect differences of opinion.

7 Q. On cross-examination, you were asked about  
8 Utah's reliance on fossil fuel for the production of  
9 energy, correct?

10 A. Yes.

11 Q. Okay and you were also asked about what you  
12 would do with respect to that portfolio, let's call it.

13 A. Yes.

14 Q. And I think, just to get us going, your  
15 response was that you would move towards diversifying  
16 that portfolio as quickly as possible. Is that right?

17 A. Yes.

18 Q. Okay. In looking at diversifying an energy  
19 portfolio for a state or for an area, like Utah, what  
20 are the main factors that you would look at in terms of  
21 choosing which resources to focus on?

22 A. Well, it's the combination of the cost, the  
23 time to market, the risk and, so, building a portfolio,  
24 you want to add assets that involve relatively low  
25 risk. You would like them to be quick to market, small

1 in impact, low cost; thereby being less risk. So, you  
2 want to add those kinds of assets to your portfolio  
3 which, in some cases, come at lower risk and lower  
4 cost. Some case, they come at only lower risk.  
5 Sometimes, they come at only lower cost.

6 Q. I'm going to hand you a document and it's a  
7 document that's been marked as Exhibit 82.

8 A. Thank you.

9 Q. No. I'm sorry, Exhibit 78. Do you recognize  
10 this document?

11 A. Yes, I do.

12 Q. What is it?

13 A. This is the levelized cost of clean energy  
14 options in PJM. The source is John Rowe who made it  
15 available to the public and, in the circumstance, this  
16 is the PJM version of that chart. The top graph is the  
17 PJM version of the big chart.

18 Q. Okay. So, explain—oh, yes, could you  
19 identify—

20 A. PJM is, as I said, it's the power pool—it used  
21 to be Pennsylvania Jersey Maryland, that mid-Atlantic  
22 region. It's a tight power pool in that region.

23 Q. So, explain to me what this top chart shows.

24 A. Well, the top chart has one, two, three, four,  
25 five—or, two, four, six, eight, ten or eleven—ten



1 resources arrayed by--in here, the width of the bar  
2 represents the magnitude of the potential contribution  
3 in the time frame they are analyzing. So, the fatness  
4 of the bar says how many kilowatts could I get and,  
5 then, the height of the bars are the levelized cost of  
6 those kilowatts. That's the top chart.

7 Q. Okay. So, and, then, I guess, the legend  
8 identifies what each of those resources are, correct?

9 A. Yes. So, the two--the bottom chart does the  
10 same thing, but measures the cost in terms of cost per  
11 ton of carbon reduced which is, obviously, a metric  
12 that people are concerned about.

13 Q. Okay and which of the bars on that top chart--

14 A. Well, I've identified the bars. The nuclear  
15 bar, as I said, is down at the back end and you'll see  
16 the fascinating thing in this chart is that clean coal,  
17 with carbon capture and storage, and nuclear costs are  
18 seen as very close in the PJM region. The last bar is  
19 solar. The next bar is carbon capture and the third  
20 most costly is nuclear and that is the fascinating--the  
21 remarkable thing is that the cost of nuclear has come  
22 to be just competitive with carbon capture and, again,  
23 this is a forward-looking price.

24 Q. And which bar is the widest or the, I guess,  
25 the largest?

1           A. Well, the interesting thing is that, in the  
2 top graph, nuclear upgrades is a fat bar, but it turns,  
3 as I've said, in the last couple of years, nuclear up  
4 rates are not very attractive and they've been  
5 abandoned like heck. So, this was, probably--under-  
6 estimated the cost.

7           In the bottom, nuclear upgrades make a much smaller  
8 contribution. The bar is much skinnier because there's  
9 a hundred megawatt increments you can make at a limited  
10 number of plants. So, you can't get that much from  
11 nuclear.

12           In both cases, nuclear is a moderate bar, probably  
13 skinnier than most of the other bars.

14           Wind is a fat bar here and wind—we don't think  
15 about Pennsylvania Jersey Maryland as particularly rich  
16 wind resources and, yet, that's a pretty fat bar. The  
17 cost is not low, but it's—and this beats nuclear.

18           The other thing I would point out about this is  
19 that you have a set of options that have negative  
20 carbon [inaudible]

21           Q. You're talking about the lower graph?

22           A. The lower graph, you have the first set.  
23 That, simply, says you can buy that energy for less  
24 than the current average cost of electricity and this  
25 is the anomaly we talked about, about efficiency,

1 combined heat, power, things like that, that people  
2 haven't exploited yet and, so, you have this negative  
3 cost and you get a certain amount.

4 If you look here, you're up to, in PJM, you know,  
5 60 million tons, without incurring any significant cost  
6 and, so, you know, and that's the stuff on the left  
7 side of that picture.

8 Q. Okay. You were asked about some of the  
9 specific resources.

10 A. Yes.

11 Q. Okay. Could you turn to Exhibit 68? It  
12 should be in front of you, and I want to refer you to  
13 page 2.

14 A. Yes.

15 Q. And it's part of the executive summary and it  
16 is-

17 MR. WRIGHT: What Exhibit? I'm sorry.

18 MR. FLITTON: Sixty-eight.

19 Q. Well, first, let me ask you to identify this  
20 document.

21 A. It's the 2013 integrated resource plan for  
22 PacifiCorp.

23 Q. Okay and are you familiar with that document?

24 A. I had looked at it before. I had looked at  
25 some of the cost projections in one of the appendices.

1 I hadn't looked at this.

2 Q. Okay and could you—it's the—I guess, it's the  
3 second paragraph. It's the paragraph just below the  
4 figures on page 2.

5 A. Yes.

6 Q. Could you read that paragraph, please?

7 A. The whole paragraph?

8 Q. Yes.

9 A. In all portfolios in the 2013 IRP, energy  
10 efficient resources play an important role in meeting  
11 load growth throughout the front ten years of the  
12 planning horizon. In the 2013 IRP preferred portfolio,  
13 the accumulated acquisition of incremental energy  
14 efficiency resources meets 67 percent of currently  
15 forecasted load growth from 2013 to 2022 levels and the  
16 2013 IRP action plan identifies steps the company will  
17 take in the next two to four years to accelerate  
18 acquisition of cost effective energy efficiency  
19 resources.

20 Q. Okay. So, what's that paragraph talking  
21 about?

22 A. Well, it, basically, says it will meet two-  
23 thirds of its load growth from efficiency and it has  
24 identified steps that will accomplish that goal and  
25 this is for a decade. So, that's a fairly substantial

1 time horizon.

2 Q. Okay. So, in other words, PacifiCorp is  
3 incorporating efficiency into its resource-

4 A. Yeah and others around the country. I've,  
5 recently, been asked about Dominion. They've come  
6 forward with a 15-year plan that relies on these kinds  
7 of resources as well.

8 Q. Okay and you're familiar with IRP's of other  
9 utilities, correct?

10 A. Yes. Yes.

11 Q. Okay and is this typical of other utilities to  
12 be incorporating efficiencies into play?

13 A. Well, IRP's are, now, looking hard at these  
14 alternative resources, in part, because the cost of  
15 nuclear frustrated. Dominion was one that had hoped to  
16 add a reactor and, now, that's just well out past their  
17 planning horizon.

18 Q. Let me hand you another document. This has  
19 been marked as Exhibit 79. Are you familiar with this  
20 document?

21 A. Yes, I am.

22 Q. What is it?

23 A. Well, what I did here was to address the  
24 question of the expectation about natural gas prices.  
25 Do we know what they're going to be? No. Can we use

1 data, experience to formulate expectations and, so,  
2 here, I asked the question what percentage of the  
3 period since de-regulation, that was, obviously, a  
4 major event in the natural gas market. We've had a  
5 functioning natural gas market, now, for almost 30  
6 years. Since de-regulation, what percentage of the  
7 time has the price of gas been high or higher than each  
8 one of these numbers and it turns out, as I said, the  
9 historical experience is that natural gas has been  
10 generally low since de-regulation. The marketplace has  
11 worked.

12 The percentage of time where it would be high is  
13 very low and this was done in conjunction with an  
14 analysis that asked the question how high would gas  
15 have to go to make the nuclear reactor economic and the  
16 answer is the likelihood, based on history, that gas  
17 will be high enough to make nuclear a good investment  
18 is very low and that's what you've got to do when we  
19 don't know the future.

20 Q. You were also asked about cost trends with  
21 respect to solar energy, correct?

22 A. Yes.

23 Q. Okay, I'm handing you what's been marked as  
24 Exhibit 80. Are you familiar with this document?

25 A. Yes.

1 Q. What is it?

2 A. Well, it, again, it's the historical cost  
3 trend. Don't have it back to '85, as I had for gas,  
4 since there's more data, but this one goes back to '98,  
5 and this one looks at the actual historical cost trend  
6 for solar installations of various sizes and, then, it  
7 also adds, on the end of that, the Lizard. Lizard is a  
8 Wall Street analyst who, as I said, it's on that chart.  
9 They do many resources and they have projected out  
10 solar prices and, so, I've added those to suggest that  
11 I'm not, you know, it seems, to me, they see it as a  
12 pretty continuous trend and, again, this is a very  
13 significant—in this case, it's a 20-year period.

14 Q. Okay. So, what this chart is showing is a  
15 downward trend in—

16 A. The historical downward trend and the opinion  
17 of one Wall Street analyst whose job is to try and get  
18 this stuff right. He doesn't have an interest in one  
19 technology or the other. That's why I find—and he  
20 includes efficiency, which is very rare and that's  
21 really important. So, I tend to use Lizard a lot.

22 Q. You were also asked about wind power.

23 MR. WRIGHT: Got the number?

24 Q. This is Exhibit 81 that I'm handing you and  
25 you're familiar with this document, right?

1 A. Yes.

2 Q. Okay. What does it show?

3 A. Well, again, this is the history and, again,  
4 the actual history. This one goes back to '85. The  
5 date is available and, then, it combines it with some  
6 estimates of future. Here, I've based this on the  
7 overnight cost from the California Energy Commission.  
8 I think they are disinterested; although I gather  
9 there's some suspicion about that and, again, it shows  
10 the long-term historical trend.

11 The interesting—this is onshore and, so, onshore  
12 has been through a very, very substantial cost  
13 production and, so, we would expect the learning curve  
14 to be less steep. They've covered a lot of distance  
15 and where we are today, certainly, in the mid-west,  
16 it's beaten the bejesus out of the market clearing  
17 price.

18 So, wind is pretty competitive, on a levelized  
19 cost basis, with—a little more costly than gas, but a  
20 lot less than the other things and people expect a  
21 moderate downward trend and this is, again, history and  
22 opinions from experts about where things have gone and,  
23 again, that's what we have to do when we think about  
24 the future. We don't predict it. We don't guarantee  
25 it, but we have to think about it because you have to



1 make some long-term decisions.

2 Q. Okay. So, I'll refer you back to-

3 MR. FLITTON: What number is this? This chart,  
4 what number is this one?

5 MS. SWENSEN: Oh, 78. Sorry.

6 Q. Seventy-eight, Exhibit 78.

7 A. Seventy-eight.

8 Q. Okay. So, this chart is a chart that shows  
9 what PJM's analysis is of the cost of these various  
10 resources, correct?

11 A. Yes.

12 Q. Is that typical for Utah? That sort of  
13 planning process and looking at alternatives to meet  
14 growing power demand or whatever it may be?

15 A. You could, certainly, dig into PacifiCorp and  
16 find a set of numbers for the top graph.

17 Q. So, in general, utilities across the country  
18 are planning to meet that future demand in their-

19 A. Absolutely. More and more utilities-(A) they  
20 do this analysis; and (B) when you do this analysis,  
21 you reach the basic conclusion that there's a lot of  
22 things you can do that are fairly low cost, a lot less  
23 costly than nuclear.

24 Q. Okay and are they investing in these resources  
25 as well?

1           A. Oh, absolutely. Clearly, PacifiCorp has said  
2 this is where they're going to meet two-thirds of their  
3 need. Dominion said this is where they're going to go.  
4 So, they do it all the time. They're doing it more  
5 because they have to think harder about it.

6           Q. Just one last thing. You were asked about the  
7 water statute and the criteria, correct?

8           A. Yes.

9           Q. And I think you mentioned that there were four  
10 factors.

11          A. I was asked to familiarize myself with the  
12 section of the statute. Those four factors were  
13 clearly there and I was focused on two of them. As I  
14 said, you do get a residual opinion about a third one,  
15 but the two primary ones—the four were—

16          Q. Okay. Are those the only factors, those four?

17          A. Those are the only ones I looked at. There  
18 may be others.

19          MR. FLITTON: Okay, thank you. That's all I have.

20          THE COURT: Re-cross?

21          MR. WRIGHT: Yes. Thank you, Your Honor.

22          RE-CROSS-EXAMINATION

23          BY MR. WRIGHT:

24          Q. Do you know what California is currently  
25 paying per kilowatt hour?

1           A. I do not know their cost. They, probably,  
2 have a fairly high cost.

3           Q. Fourteen, almost fifteen cents. Does that  
4 sound about right?

5           A. That's residential, at the meter, I would  
6 assume.

7           Q. How about Wisconsin?

8           A. I do not know the cost in Wisconsin.

9           Q. How about Vermont?

10          A. I do not know the cost in Vermont.

11          Q. If I told you sixteen?

12          A. It's, probably, a high-cost state.

13          Q. Do you know what we're paying in Utah?

14          A. Again, I would expect it's a low-cost state.  
15 So, it's, probably eight or ten-eight, ten. You can  
16 tell me.

17          Q. A little over eight.

18          A. Yeah.

19          Q. The PacifiCorp IRP, do you know what an IRP  
20 is?

21          A. Yes.

22          Q. What is it?

23          A. It's an integrated research plan.

24          Q. Okay. I know what it's called. What does it  
25 do?

1           A. Well, it lays out a series of options and  
2 tells the public utilities commission, which is usually  
3 the target audience, how they could meet the need for  
4 electricity over whatever the period of time is. Ten  
5 years is pretty good period, yes.

6           Q. And how far out is the actual action plan  
7 under an IRP, at least the PacifiCorp IRP?

8           A. You know, they said they've taken the action  
9 for two to four years. That's what they said in that  
10 paragraph.

11          Q. Could you turn to Exhibit 66 in the binder?  
12 Do you know whether PacifiCorp predicts a short-fall of  
13 capacity out, say, over the next decade?

14          A. This graph suggests there is a shortfall.

15          MR. WRIGHT: Nothing further, Your Honor. Thank  
16 you.

17          THE COURT: Any questions, Ms. Valdes?

18          MS. VALDES: No, thank you.

19          THE COURT: Okay. Dr. Cooper, thank you for your  
20 help today. I really appreciate it.

21          DR. COOPER: Thank you.

22          THE COURT: It's been very interesting. Do  
23 Plaintiffs have a next witness to call?

24          MS. SWENSEN: Plaintiffs will call Professor  
25 Harold Tyus to the stand.

1 THE COURT: Harold Tyus?

2 MS. SWENSEN: Yes.

3 THE COURT: Professor Tyus, if you would come  
4 forward, Sir.

5 [Inaudible discussion.]

6 THE COURT: And, Professor, if I could have you  
7 raise your right hand and be sworn, Sir?

8 DR. TYUS: I'm sorry?

9 THE COURT: If I could have you raise your right  
10 hand and be sworn.

11 DR. TYUS: Yes.

12 DR. HAROLD M. TYUS called as a witness by the  
13 Plaintiffs, being first duly sworn, was examined and  
14 testified on his oath as follows.

15 THE COURT: If you would have a seat in the  
16 witness chair, please, Sir.

17 DIRECT EXAMINATION

18 BY MS. SWENSEN:

19 Q. Good morning, Professor Tyus. Can you hear me  
20 all right?

21 A. Yes.

22 Q. Okay. I have a tendency to move away from the  
23 mike and not be as audible. So, let me know if you  
24 ever can't, all right?

25 A. All right. Okay.

1 Q. You're good. Dr. Tyus, will you tell us a  
2 little bit about your educational background?

3 A. Yes. I have a B.S. degree in chemistry and  
4 mathematics from Florida Southern College. I have a  
5 master of science in zoology, emphasis in theology,  
6 from North Carolina State University and I have a Ph.D.  
7 from there as well.

8 Q. Explain to the Court any publications that  
9 you've made on endangered fish.

10 A. Well, I have a-

11 Q. And I apologize. I realize that you have a  
12 textbook that I meant to hold up at this moment, and it  
13 is not in the Courtroom, but if you could just describe  
14 a few of your publications on the endangered fish.

15 A. Well, as far as the Colorado River fish, I  
16 think I have more publications than any other person.  
17 I have about 60, plus or minus, publications. About  
18 half of those are peer-reviewed and the other half are  
19 government reports and technical papers and I have  
20 papers written about fish, in general; specific papers  
21 written about fish taxa and, then, quite a few things  
22 written about habitat and environmental requirements  
23 such as extreme flows and so forth and so on.

24 Q. And, in fact, you're aware that Dr. Hardy has  
25 given testimony in this case for Blue Castle, correct?

1 A. Yes, I am.

2 Q. And hasn't he, in fact, referred to or cited  
3 several of the papers that you co-authored?

4 A. Yes, I believe so.

5 Q. Tell the Court, specifically, about  
6 publications you've made on the Colorado Pipe Minnow.

7 A. Well, in 1979, I was able to assume the  
8 position of a project leader working on the endangered  
9 fishes out of Colorado and Utah. So, I've actually  
10 been in western Utah for 12 years and we studied about  
11 700 miles upriver to try to determine basic information  
12 about the fish that we was lacking. Lacking, I'm  
13 referring to a need for an environmental assessment and  
14 environment impact statement on the operation of  
15 Flaming Gorge Dam and other things.

16 Q. And, when you refer to you spent 12 years  
17 studying approximately 700 miles up the river, are you  
18 referring to the Green River?

19 A. Yes, the Green, the White and the Yampa. The  
20 Green from Flaming Gorge down, all the way to the  
21 confluence and other rivers as well.

22 MR. WRIGHT: Your Honor, if it will save time, we  
23 will stipulate that he's an expert on the fish and,  
24 particularly, the endangered fish, unless there's  
25 another reason you want to do it.

1 MS. SWENSEN: We're about to the axis. I think  
2 it's helpful to establish the familiarity with region,  
3 as well as [inaudible], but I appreciate that.

4 MR. WRIGHT: Sure, but we'll stipulate.

5 MS. SWENSEN: Okay.

6 Q. So, particularly, have you worked with  
7 regional and national authorities for fish and wildlife  
8 management in altered systems?

9 A. Yes. As part of my responsibilities, I worked  
10 as a liaison between the regulatory part of the Fish  
11 and Wildlife Service, speaking mainly to the Endangered  
12 Species Act, but others as well, and the need to obtain  
13 scientific information so we can make a decision about  
14 things such as flow releases.

15 Q. And your book published in 2011 is titled  
16 Ecology and Conservation of Species? Do I have that  
17 title correct?

18 A. Of Fishes, yes.

19 Q. Of Fishes, thank you.

20 A. Yes. It's an upper division textbook.

21 Q. Okay. With respect to the—you testified  
22 you're fairly familiar with the Green River, among  
23 others. Are you aware of whether any part of the Green  
24 River has been designated as a critical habitat for the  
25 Colorado Pipe Minnow?



1 A. Yes.

2 Q. Are any of the critical habitat regions below  
3 the point of for the proposed Blue Castle diversion?

4 A. Yes. A very critical area. I hate to use the  
5 word critical too many times here.

6 Q. You can't use critical too many times.

7 A. Well, the Green River of Utah, I mentioned I  
8 took charge of a research station in 1979 and part of  
9 our job was to divide up the river basins into strata  
10 that were different and, then, allow us to infer, from  
11 our collections, what the habits of the fish might be  
12 and their habitat might be in these regions and one of  
13 these areas occurs south of the Town of Green River,  
14 Utah, and I think that's the one you're referring to.

15 Q. Yes.

16 A. All total, there was—let's see, I think I  
17 referenced the March 21, 1994, final rule on the  
18 critical habitat for the endangered fishes and, so,  
19 this is a very important region or reach of the river.

20 Q. And I had asked you specific to the Colorado  
21 Pipe Minnow, but I, probably, shouldn't have narrowed  
22 it to that extent. Are you aware of any other  
23 endangered fish for whom that stretch of river is  
24 important?

25 A. Yes. It's also critical habitat for the

1 Razorback Sucker, Humpback Chub and Bonytail for the  
2 large river fishes that are either negative or endemic  
3 to the Colorado River Basin and, in particular, the  
4 Green. Let me just say the Pipe Minnow has been  
5 extirpated from over eighty percent of its range and  
6 the critical habitat where it is currently within the  
7 Upper Colorado River Basin. So, this is it. This is  
8 the last threshold here for the Pipe Minnow is the  
9 Upper Colorado Basin.

10 The other fishes include areas of potential  
11 recovery not only in the Upper Basin, but in the Lower  
12 Basin as well. I don't know if that's germane to your  
13 question, but-

14 Q. That helps because I would like to ask some  
15 questions about the Colorado Pipe Minnow, in general,  
16 and for moving things along. I'm not saying that the  
17 other endangered fish are not affected, but let's focus  
18 on the Colorado Pipe Minnow since, as you've testified,  
19 this is a particularly important habitat for them,  
20 correct?

21 A. Yes.

22 Q. Yes. So, explain to me, in the life of the  
23 Colorado Pipe Minnow, how they would, first, be  
24 affected by the proposed diversion.

25 A. Well, it's called a reproductive strategy, or

1 whatever.

2 Q. The reproductive strategy of the fish?

3 A. Yes.

4 Q. Please explain.

5 A. If I could just say that we're talking about  
6 the Pipe Minnow. I think you have a picture somewhere  
7 around here, don't you, of the Pipe Minnow?

8 A. I do not at this moment.

9 Q. Okay. This is a very interesting creature.  
10 It is a fish that reached sizes approaching five and a  
11 half feet in length and weights of about 80 pounds.  
12 They're still captured today with weights up to about  
13 20 to 30 pounds, but the 80 pound ones are very, very  
14 rare and the reproductive strategy of this particular  
15 organism is what we would call the k-adapted strategy,  
16 from an ecological perspective. That means they attain  
17 large sizes and have very powerful—are able to move  
18 long distances, produce a lot of eggs and young and are  
19 able to, over a period of time, interact with other  
20 species in a competitive way.

21 As an ecologist, I look at energy cost and I guess  
22 you're looking at energy from a different perspective,  
23 but we look at energy as to the amount of effort an  
24 organism will put into what it does as related to in  
25 ports of their life history. The Pipe Minnow being a

1 large species, they live in a big river system.  
2 Obviously, the Green is our biggest unit in this area.  
3 They're powerful and they migrate from where we had no  
4 idea, originally.

5 We had a difficult time with their life histories  
6 and, so, what I would like to do is to say here is a  
7 way to understand how this works. Organisms, humans,  
8 whatever, impart energy to our offspring in the form of  
9 flesh, food and, in fishes and chickens, for a common  
10 example, the amount of yolk that's put into the egg.  
11 Now, there's a couple of ways that energy can be  
12 transferred into an organism and the way chickens do it  
13 is with a large egg.

14 Pipe Minnow don't do that. They produce a lot of  
15 smaller eggs and the energy put into the offspring is  
16 done by the female before the offspring are even laid.  
17 Now, let me explain this. How does this happen?  
18 Well, the adult fishes are migrators and they move into  
19 areas that are particularly good for raising altricial  
20 larvae. The larvae of the pipe minnow develop from  
21 very tiny eggs with a very small amount of yolk. So,  
22 the effort isn't being put into the young in that way.  
23 The energy expended by the fish place them in a  
24 position to where they can have a good start on life.

25 Q. That would be the nursery?

1 A. That would be spawning areas.

2 Q. Pardon me. They place the egg in the spawning  
3 area and, then, anticipate that it will move down to a  
4 nursery habitat? Explain how that happens.

5 A. That's, kind of, anthropomorphic. Let's just  
6 say that those that are placed in the position that  
7 allows the larval fish to have needed access to food  
8 when it's necessary, or one that persists, if the  
9 adults lay eggs in a different spot, the young may not  
10 live and, so, over thousands, hundreds, in this case,  
11 maybe, six million years, they have located the spots  
12 that are good for their young to survive.

13 When I first started working on this organism,  
14 they had no idea where the fish spawn, for example, and  
15 they thought, well, here's where the young are. That's  
16 where the fish are. Well, we couldn't find any  
17 spawning fish at all. It was a great mystery until we  
18 were able to use a new contraption called an  
19 implantable radio transmitter. So, I, personally,  
20 captured, with my field crew, and I, personally,  
21 implanted 152 Colorado Pipe Minnow with radio  
22 transmitters and was able to find out where they went  
23 and what we found was a complete surprise.

24 Q. Where did they go?

25 A. Our monitoring of the area where the young had

1 been found the previous year produced no adults.  
2 Adults just, simply, disappeared and we found them way  
3 up in Yampa Canyon and way down in Desolation Canyon.  
4 They would migrate, some fishes, up to 100 miles. We  
5 had one fish that came from Meeker, Colorado, all the  
6 way down the White River, entered the Green River.  
7 Migrated up the Green River and into the Yampa River to  
8 a spawning area in Yampa Canyon, about river mile 18.  
9 Very energy consumptive-type of behavior and very  
10 interesting. So--

11 Q. So, after they lay the eggs in the spawning  
12 area, what happens next in the life cycle of the  
13 Colorado Pipe Minnow?

14 A. Well, the eggs are small and they're adhesive.  
15 They adhere to rocks and things and, as I said,  
16 they're altricial larvae, which means they don't have a  
17 lot of energy. Therefore, an embryo to develop from.  
18 The fish undergo a period of development, feeding  
19 entirely off of the yolk, until they become about 7 mm  
20 in length and most of the yolk sack is used up. They,  
21 then, swim up in the water column and they're entrained  
22 and transported downstream.

23 As a rule of thumb, the river was moving somewhere  
24 like five to six miles per hour, if you can become  
25 entrained in the flow, and that's enough to take you

1 far away in a very short time. So, within a few days  
2 to a week, they could be transported as far as 50 to  
3 100 miles downriver.

4 Q. And that takes them to the portion of the  
5 critical habitat that has been referred to as the  
6 nursery habitat?

7 A. Yes. We have located areas where they  
8 concentrate. I bet you have that in the slide.

9 Q. I do.

10 A. Where they concentrate and we found two  
11 spawning areas for the whole river system.

12 Q. Go ahead.

13 A. And we have confirmed two nursery areas 40 to  
14 120 miles downstream. Now, you have to remember that  
15 the big fish are spawning in a canyon. There's lots of  
16 rocks, very low predators. Good place to raise small  
17 fish up to where it can swim, but not a very good place  
18 to provide food for them.

19 So, as the water comes out of these canyons, then  
20 drops off the heavier material, it winds-up being a  
21 [inaudible] material or fine material into downstream  
22 reaches and it's those nursery areas that we focused on  
23 and were looking at the potential impact of this power  
24 plant, what might happen with the—

25 Q. Let me hand you what's been marked as Exhibit

1 83. I believe this is the map you were referring to.

2 A. Right.

3 Q. So, this shows the—has marked the spawning  
4 areas and the nursery areas that you were describing,  
5 correct?

6 A. That's right.

7 Q. And the spawning—or, excuse me, the nursery  
8 areas fall downstream—a portion of the nursery areas  
9 fall downstream of the proposed diversion that we're  
10 discussing, correct?

11 A. Yes. If you look at your map, down below the  
12 San Rafael, you'll see that that is a checkered area.  
13 So, that would be the nursery area there.

14 Q. Okay. So, the eggs are laid up in—you see up  
15 above the Price River there, correct? Is it the dark—

16 A. The area in black. That would be—that's just  
17 about centered at the beginning of Gray Canyon.

18 Q. And, then, the eggs, as you've described it,  
19 after they've consumed most of the yolk—

20 A. Yes.

21 Q. -drift downstream to the nursery areas  
22 identified on this map, correct?

23 A. That's correct.

24 Q. And describe for the Court what the nursery  
25 area have to entail in order to be successful for the



1 growth of the young larvae.

2 A. Well, remember. These are altricial larvae  
3 that don't have very much food. I made a point of that  
4 several times.

5 Q. Well, and when you say altricial larvae, just  
6 so we understand, you described that, at full maturity,  
7 these are massive fish. At this stage, do they have  
8 fins?

9 A. Well, it's a gamble. You either produce a  
10 small number of very large, almost like their parents,  
11 such as trout. When they emerge, they're capable of  
12 eating the [inaudible] and stuff that we tie flies for  
13 and try to catch them with. These little altricial  
14 fish are not like their adults. It's what we call  
15 oclogenetic evolution. It goes through stages and,  
16 then, it becomes—like an insect might go through  
17 several different stages, these fishes do that.

18 So, what's transported downstream is a small blob  
19 of protoplasm, if you will, only about seven  
20 millimeters or so in length and, when they finally  
21 wind-up down in the nursery area, they have to be  
22 delivered into a place that's got food that they can  
23 eat. It's so abundant that they're almost bumping into  
24 each other, the fish and the food. So, there's plenty  
25 of food for them to eat so they can continue their

1 development. They may not have the fins fully  
2 developed yet. May not have the division. May not  
3 have the gastrointestinal tract fully formed even. So,  
4 they actually just are like little blocks.

5 Q. So, in short, they're extremely vulnerable at  
6 that phase of their life.

7 A. Extremely vulnerable, yes, but growth is  
8 fairly fast and, so, then, a few weeks, in a good area,  
9 which has food and protective habitat, which we will,  
10 obviously, talk about, here, in a minute, they can  
11 begin to grow and grow very quickly.

12 Q. And let's talk about—I believe in ecology  
13 terms. It's the constituent elements of a critical  
14 habitat, what is necessary for that to qualify as  
15 critical habitat, correct?

16 A. Right and, so, in the publication from 50  
17 C.F.R., the Fish and Wildlife Service, I have that,  
18 here, on my stand. They list the critical habitat and  
19 they list the constituent elements of critical habitat  
20 which would be, of course, food organisms, low number  
21 of predators, hopefully, and protection of habitat and,  
22 in some instances, fishes' florativity. I think that's  
23 the case here, that they use florativity for cover as  
24 well as being able to find shallow, ephemeral habitat  
25 known as backwaters which can be very rich in the foods

1 that they eat, from zooplankton to whatever and I  
2 reference a paper in this report that I did that's been  
3 shared by others where they identified a large number  
4 of food items produced in these shallow backwaters.

5 Q. So, and what you just said is important to  
6 understand that these nursery habitats are in the more  
7 ephemeral backwaters, as you described it. The larvae,  
8 could they survive just in the main channel of the  
9 river?

10 A. The newly-hatched larvae?

11 Q. Uh-huh [affirmative].

12 A. Absolutely not. They have to have food. They  
13 have to have habitat. They have to have protection and  
14 that's very difficult out there in the main river.

15 Q. Okay. Are there any other factors that make  
16 the species here more sensitive to change?

17 A. Could you re-phrase that? I'm not sure I  
18 understand.

19 Q. Sure. Are there any other developments, we  
20 could say, that have made the species in this area  
21 particularly sensitive to changes such as non-native  
22 species or climate change?

23 A. Well, yes. If you look at all the fully  
24 endangered species, at least you find out that they're  
25 perfectly adapted for a river system and, in fact, they

1 divide-up different habitats in the river system,  
2 spawning at different times of the year and having  
3 nursery areas such as that in different places. So,  
4 using all these different habitats, but there were only  
5 about 14 fish and, maybe, some other real good species.  
6 For sure, we had 12 good species of fish in the Upper  
7 Colorado River Basin. So, that's a very low number.

8 In an equivalent stream, for example, in Missouri,  
9 you might have 80 species or so. So, it's a low number  
10 of species and I won't go into detail of how they  
11 partition the habitat up, but they do it with these  
12 life stages, these ontogenetic stages of their  
13 development. They eat different foods. So, the young  
14 Pipe Minnow would be eating zooplankton, but the adult  
15 Pipe Minnow is eating large fish. So, they had the  
16 whole thing divided-up and figured out in their own  
17 system.

18 Q. We've heard—

19 A. Now, they're as much as 60. Non-native  
20 species have been added into the Basin that interact  
21 with the endangered species in various ways. Some of  
22 the endangered species actually eat them. Others are  
23 eaten and, so, in the backwaters, now, we not only have  
24 the north zone occupied by Pipe Minnow and some other  
25 native species, but we have ingressive, invasive fishes

1 like red shiner and fat head minnow that live in the  
2 backwaters with them and, so, that complicates the  
3 whole matter of trying to figure out what you do.

4 Q. We've heard Dr. Hardy testify that, in the  
5 stretch of river downstream from the proposed  
6 diversion, to the confluence with the Colorado, that  
7 there are not very many backwater habitats in terms of  
8 a percentage of the total distance. Do you think that  
9 makes them insignificant?

10 A. Well, I'm sorry. I'm a scientist. I have to  
11 get this explained to me. What do we mean when we say  
12 not many. What are we comparing that to? I'm not  
13 sure.

14 Q. If we take the total distance—testimony was  
15 presented that the total distance from, say,  
16 approximately Green River to the confluence with the  
17 Colorado, that a small percentage, distance-wise,  
18 constituted a backwater habitat. Do you disagree with  
19 that calculation?

20 A. A small area?

21 Q. Correct, in area only.

22 A. I wouldn't say that the backwater habitats are  
23 really abundant in too many places in the river system  
24 to start with.

25 Q. Right.

1           A. We looked at some, here, recently and we had a  
2 hard time finding some. So, they are not everywhere.  
3 It's not abundant anywhere, as far as I'm concerned.  
4 Now, you, maybe, say there are less in this part of  
5 the river than in some other part of the river. That's  
6 the sense I made of that and-

7           Q. But does that diminish the importance of the  
8 backwater habitats in this stretch of river?

9           A. No. I think the opposite way. If there's not  
10 very many of them, then, they would be more important  
11 because, if they didn't have any, they wouldn't have  
12 any fish.

13          Q. Correct. So, when you—you testified regarding  
14 the study that you did beginning in, I think '79, and  
15 going for at least 12 years. Are you also familiar  
16 with any more recent studies that evaluate the lower  
17 Green River nursery areas?

18          A. Oh, yes. We have about 20—I think it's 23  
19 years, I mentioned, of monitoring in these areas. I  
20 said monitoring. The studies we did were to determine  
21 baseline. What I mean by that is we looked at all the  
22 different possibilities that the fish might use an area  
23 for habitat. So, we looked at big backwaters and small  
24 backwaters and eddies and runs and ripples and the  
25 whole thing to try to figure out what type of habitat

1 they were using and, then, the basis of what we did,  
2 that is in the report that I did for you, is, then,  
3 taken and filtered through the process of selecting  
4 index stations to re-sample on a regular basis and, so,  
5 they looked for and picked-out the same backwater  
6 example over and over again.

7 So, index is a good way of looking at standing  
8 craw, but it's a poor way of looking at habitat  
9 selection, but we have this data and we have a  
10 tremendous amount of data in these nursery areas and  
11 it's every year and what that data is showing us is  
12 that the Green River, downstream--well, you see the two  
13 nursery areas. The middle green, there, and there,  
14 Ouray, and, then, the lower Green, near the confluence.  
15 The middle area has lost some of its florativity,  
16 evidently, and the fish are not as abundant as they  
17 have been in the past; whereas, the most important area  
18 left seems to be the area in the lower Green.

19 Q. That would be potentially affected by the  
20 proposed withdrawal of water?

21 A. That would be what, now?

22 Q. That would be affected by the proposed  
23 diversion. You say the lower Green.

24 A. Oh, yes, downstream of the proposed project,  
25 yes.

1 Q. Are you aware of any studies, or have you been  
2 involved with any, that indicate the importance of  
3 minimum flows to preserving Pipe Minnow populations?

4 A. Well, when we started our work in 1979, it was  
5 for a three-year study to look at minimum flow  
6 requirement for the endangered fish. So, our task was  
7 to try to find minimum flow that would be used to  
8 recover or to save the fish and what we found out was  
9 really an important thing.

10 I mentioned the fishes are adapted to the river  
11 system. We found out that minimum flow concept is not  
12 a very good one. Not only does minimum flow often  
13 wind-up being the only flow, fish don't benefit from it  
14 because it doesn't produce a lot of different kinds of  
15 habitat and, so, we found that minimum flow, a magic  
16 number that would solve the problem for all the fish,  
17 does not exist. Instead, it's a range of flows and let  
18 me give you an example.

19 We all know what an eddy looks like, I would  
20 assume, as it's going round and round in a circle. So,  
21 at higher levels, the water is very powerful and it ate  
22 out the banks and creates side channels and, then, as  
23 water goes down, lower, then, we have these exposed  
24 areas of habitat that we refer to as backwaters.

25 The same thing happens to transport material



1 downstream. The river is large, powerful. It's  
2 flooding. It's carrying material downstream. Then,  
3 when it begins to decline, this material is deposited  
4 and a lot of that material is organic material that  
5 provides for the nursery habitat.

6 Q. And you are familiar, I believe, with the  
7 Green study in 2011 reporting catches of Pipe Minnow  
8 that declined during the drought period? Is that  
9 correct? Can you explain that to us?

10 A. Yes, that's right.

11 Q. Explain to us why that would affect the fish.  
12 I understand you just explained the importance of  
13 having both peaks and low flows, but explain why more  
14 low flows than expected are bad for the Pipe Minnow  
15 population.

16 A. Well, there's not much habitat in dry  
17 conditions. As the antecedent flows came down and  
18 deposited fine material and provided for the  
19 backwaters, then, the fish used these habitats and were  
20 able to grow and have a good time of it, but with low  
21 flow conditions, a lot of the backwaters are  
22 [inaudible] and the fish are forced to move out into  
23 more of the main channel of the river and it's  
24 dangerous out there because of these introduced fishes  
25 we put in like bass and Northern Pike and all the rest

1 of these things can even eat some of the Pipe Minnow.  
2 So, it forces them to move into areas that they would  
3 prefer not to do because they simply don't have access  
4 to it.

5 We did some studies on the young fish that showed  
6 that they can sense the water moving in and out of this  
7 backwater and they could get out of the backwater  
8 before it closes off and, so, that's another little  
9 trick that they have of doing that. With all that  
10 movement that living in different habitat creates an  
11 energy drain on them because they're expending more  
12 effort to find food and to also avoid predators.

13 Q. Let's move away from the nursery habitat for a  
14 moment and talk about the—is drift an acceptable word  
15 for the larvae entrainment coming downstream before  
16 they reach the nursery habitat? Describe for the Court  
17 the potential problems with a new diversion or intake  
18 structure in this section of the Green.

19 A. We're familiar with the Toshoe Wash diversion,  
20 I would assume. Everybody has—

21 Q. That has not yet been discussed. Why don't  
22 you explain your involvement with the proposed re-build  
23 of the Tusher diversion.

24 A. The proposed re-build of what?

25 Q. The Tusher diversion.

1 A. Talk about that?

2 Q. Yeah. That hasn't been discussed yet.

3 A. Well, as we worked the River, we found out  
4 that we did not have an open system every place and,  
5 right above the Town of Green River is the Tusher Wash  
6 Diversion and rafters are coming out and don't take out  
7 at Swayze's, if you know where that is. Have to run an  
8 immersion dam. It's pretty scary. So, it leaves you  
9 with a respect for what they look like and, so, this is  
10 a large, wide area in the river that's been built-up  
11 into a dam. It's been there for quite a long time,  
12 though, well before the Endangered Species Act was  
13 passed and what happens there is water is taken and  
14 diverted into the agricultural fields and, back in '83,  
15 '84, they proposed to add hydroelectric generator into  
16 the diversion—excuse me, the intake for the  
17 agricultural fields to get some power off of the thing.  
18 In order to do that, they were going to have to build-  
19 up the old diversion dam.

20 We were involved with the formal consultation with  
21 FERC on that and we asked that that be declined because  
22 we didn't want to have the young larvae entrained into  
23 this larger flow and, so, that Hunter Electric re-fit  
24 wasn't done because of the impact we felt would happen.

25 Now, we talked about these little larvae as

1 floating globs of protoplasm.

2 Q. Right.

3 A. They smack up against a screen and that's it.  
4 They're toast. They're gone and, so, imagine how  
5 difficult it would be to go out and with larval  
6 scientists trying to save the larval fish and, so, it's  
7 difficult to work with them because they're just globs  
8 and they would be almost impossible to keep them from  
9 being entrained and taken out to the agricultural  
10 fields.

11 In this case, with the hydroelectric—not a  
12 hydroelectric, but with a nuclear plant, all the water  
13 is boiled down to salt and any entrained fish would be  
14 lost.

15 Q. So, let's talk about—it sounds like, you know,  
16 for someone looking at this for the first time, that  
17 the solution is there must be simply a screen or  
18 something so that the larvae are not pulled into the  
19 intake structure or otherwise harmed. To your  
20 knowledge, is there a simple mitigation of this problem  
21 for the Colorado Pipe Minnow?

22 A. Well, there is such a thing called a  
23 travelling screen in which the intake is screened-off  
24 and everything that smacks against this screen is taken  
25 down and flushed back into the system below.

1 Q. Uh-huh [affirmative].

2 A. And, so, for larger fish, that would work, but  
3 for these little small blobs, 7 millimeters in size, I  
4 don't know of any way of screening them and keeping  
5 them alive and I discussed with the Fish and Wildlife  
6 Service representative that does consultations on this  
7 kind of effort with the screens and he agreed with me  
8 that there is no viable alternative, that they're just  
9 going to die. I acknowledge it hasn't made it yet to  
10 where we have a screen that will work on that.

11 Q. And what about the larger fish? Would a new  
12 diversion or intake structure potentially impede their  
13 movement in the river?

14 A. Well, we might want to discuss that movement.  
15 I talked about the fish that came out of the White  
16 River, that was captured up near Meeker and went into  
17 the Green. It took them two years to make that trip  
18 and, so, that was a lot of energy travelling through  
19 the system.

20 In '86, I published a paper which showed that  
21 there is a separation of life history stages in the  
22 Pipe Minnow so that the smaller fish tend to be in the  
23 lower part of the basin and, as they mature, they have  
24 a tendency to move upstream, against the flow, and to  
25 find deeper and more well-defined habitats because they

1 need a big area.

2 So, in using the regular transmitters, we actually  
3 followed the fish up through the Tusher diversion and  
4 around the dam and on up the river. So, the fish had  
5 migrated downstream and it was coming back up to where  
6 the home range was. So, they do establish a home  
7 range.

8 So, we have the larvae going down, small larvae  
9 going downstream and, then, returning back upstream we  
10 have juveniles and some adults of varying sizes all the  
11 way up to the large fish that may get up to 20 pounds.  
12 So, there's a difference in their ability to swim.  
13 So, there's a low edge of that diversion that fish  
14 can't make it upstream with the flows. So, once the  
15 flow is high enough, they can top the dam pretty well.  
16 The fish can go around and get up through it.

17 Our fear with the other project was that, if we  
18 build it up high, we wouldn't have those fish moving  
19 upstream. It would interfere with that movement  
20 because that's another thing we're worried about.

21 Q. But are you aware of any non-listed, but  
22 sensitive, species also present in the river? I should  
23 say in this stretch of the river.

24 A. Yes. I mentioned there were 12 species.  
25 Seven of those are considered the big river fish

1 species and we think they are all—seven of those are at  
2 risk. The Razorback Sucker is endangered but, then,  
3 the Flannelmouth Sucker, Mountain—I mean, the Blue Head  
4 Sucker are two we're concerned about and the other is  
5 the Roundtail Chub. So, these fishes' numbers have  
6 recently declined as well and we're quite concerned  
7 about them; that, maybe, we need to list them in the  
8 near future.

9 Q. Okay and are you aware of any ongoing  
10 conservation measures to protect the remaining big  
11 river fishes and their habitats?

12 A. Well, the Upper Colorado River Recovery  
13 Program started from the old project that we started  
14 back in '79 and I can't remember the start date. I  
15 think that was the start-up date. I want to say '87  
16 but, arguably, it's the largest recovery effort for  
17 fishes that we have going on today.

18 Q. Are you aware of—you mentioned that you're in  
19 contact with individuals from Fish and Wildlife  
20 Services. Are you aware of their position with respect  
21 to the proposed project?

22 A. Yes. I think you've already had testimony by  
23 Bates with Fish and Wildlife Service entered into your  
24 record.

25 Q. You're referring to at the administrative

1 hearing, correct, in Green River?

2 A. Yes. Yeah.

3 Q. Okay and have you had, in your preparation for  
4 this, have you had any additional conversations  
5 indicating that they have concerns about the impact of  
6 the project?

7 A. Yes, particularly with respect to the  
8 entrainment issue is one issue, but with the recovery  
9 program, they are dealing with depletions as well as  
10 direct effect on habitat. I guess they have defined  
11 their idea of what a diminimus effect would be.

12 Q. Let's talk about that. You're aware that Dr.  
13 Hardy concluded there would be a diminimus effect.  
14 What is Fish and Wildlife Services' definition of a  
15 diminimus withdrawal in the Upper Colorado River Basin?

16 A. Well, with the recovery program, they have  
17 depletions which have not been closely evaluated  
18 relative to their effect on habitat--

19 Q. Uh-huh [affirmative].

20 A. --just the depletion and, then, they have  
21 actions that could adversely affect or destroy critical  
22 habitat. So, looking at the impacts of new projects  
23 from a standpoint of this depletion, plus the habitat,  
24 with the depletions part of it, they're willing to  
25 allow their program constituencies and other agencies



1 that deal with the water issue to have depletions of up  
2 to a tenth of an acre-foot per year without having to  
3 go into formal consultation and, so, that, to them, is—  
4 they define that as a diminimus amount and that's a  
5 tenth of an acre foot per year; whereas, the impact of  
6 this power plant, as I read it, is over 50,000 acre  
7 feet a year, which is considered to be one of the  
8 largest depletions they've ever encountered.

9 Q. On the stretch of river?

10 A. So—yes. So, it's, kind of, like me saying  
11 that, as far as I'm concerned, I'm willing to allow  
12 enough water for me to brush my teeth, but I'm not  
13 willing to allow a lot more than that because of the  
14 effect it would have on the critical habitat.

15 Q. You're aware that Dr. Hardy has provided  
16 testimony that the proposed diversion would cause a  
17 water stage reduction of about 1.4 inches at low flows  
18 at the Green River Gauge, right? You're aware of that  
19 testimony?

20 A. Yes. I am aware of it.

21 Q. And he has also concluded that this would not  
22 result in more than a diminimus loss in fish or  
23 wildlife habitat. Do you agree with that statement?

24 A. No.

25 Q. Explain why not.

1 A. Focusing on the nursery areas—

2 Q. Yes.

3 A. -if we look down there, number one, I would  
4 agree with him that backwater habitats are not  
5 plentiful, but in my report that I did for you, we had  
6 a drawing of a hypothetical backwater.

7 Q. Let me stop you for a moment and we'll  
8 introduce that so that you can refer to it.

9 MS. SWENSEN: I'm going to hand you what we're  
10 marking as Exhibit 84. Here's a copy of it in color.  
11 Sorry.

12 A. Four?

13 MS. SWENSEN: Eighty-four.

14 THE COURT: Eighty-four.

15 MS. SWENSEN: Yeah.

16 Q. Are you familiar with the diagram that I  
17 placed before you?

18 A. Yes. I am very familiar with it.

19 Q. And did you construct this?

20 A. Yes.

21 Q. Why don't you explain to us what this  
22 represents.

23 A. Well, there are a couple of different ways  
24 backwaters can be formed. In this particular instance,  
25 we're looking at some of the most productive backwaters

1 that occur, that form from riverside channels. If the  
2 side channel is partially dewatered, it would have an  
3 upper and lower area of a pad of water that would be  
4 open to the river, but not all the way. Just a fairly  
5 small opening, usually.

6 After slogging through the mud and the silt and  
7 everything else in some of the backwaters for quite-  
8 many years, I take it for granted that people know what  
9 they look like. I'm amazed that they don't.

10 Q. It helps to have your description. I haven't  
11 slogged to the backwaters recently.

12 A. Well, so, they're usually fairly shallow.  
13 They will have, maybe, one side of it will be fairly  
14 deep compared to the rest of it, but this map, here,  
15 shows the width of the backwater with the-quite clearly  
16 indicates how shallow most of it is and, so, I had this  
17 drawing made and we figured out that, for this  
18 particular backwater size-and this comes from the data  
19 as to what is the most abundant size of the backwaters  
20 the fish use, what they prefer, in other words, to use  
21 and, so, they prefer this kind of a backwater and we  
22 did some calculations.

23 Q. And, when you say the size, you're referring  
24 to the size and the depth, that you took an average, is  
25 that correct, for constructing this illustration?

1           A. Yes. We have the average depth and the area  
2 so we could, then, figure out how it looks from the  
3 cross-section and, so, what we found out is that, by  
4 lowering the water level of this preferred type of  
5 backwater, an inch and a half, we lost fifty percent of  
6 the area of the backwater. We lost fifty percent of  
7 the surface area of backwaters. That's a lot, and not  
8 only that, but this is the shallow part of the  
9 backwater that's occupied by the fish and also is an  
10 area where this organic matter and stuff has settled  
11 down and provides good, nice, squishy habitat for the  
12 types of paranomids, which are worm-like creatures,  
13 that the fish eat. So, we did find—it was amazing, to  
14 me, that the number is so high, but I have confidence  
15 that it is correct. So, there can be quite a bit of  
16 change in what happens in the backwaters with the  
17 lowering of the water level.

18           Now, the other problem is, of course, we're  
19 looking at this, a large, free-running river, here, in  
20 Green River, near the railroad bridge, I assume, where  
21 the staff gauge is--

22           Q. Let me back-up for a second. Just so we  
23 establish it, you're familiar with the location of the  
24 USGS gauge at Green River, correct?

25           A. Yes. Uh-huh [affirmative].

1 Q. You've actually seen it?

2 A. Yeah.

3 Q. Okay. Please continue.

4 A. So, we had mostly a run, instead of eddies and  
5 backwaters and that sort of thing. We, mostly, have a  
6 run going through here because the water is coming out  
7 of the Desolation and Gray Canyons and with quite a bit  
8 of force and it doesn't carry that much sediment and,  
9 then, it begins to get more shallow and more rippley as  
10 you go downstream. There's Salinas Wash and Crystal  
11 Geyser, down there. The river widens way out and it  
12 becomes a complete riffle. The whole river is a  
13 riffle. I know. I've hung up, several times, and had  
14 to walk it, guys. [inaudible] it's not a lot of fun.

15 So, you, finally, get down to Silver Water and  
16 Labyrinth Canyon, where the nursery habitats are, and  
17 it becomes more alluvial. You've got fine materials  
18 being deposited. You have more backwaters, although  
19 some of them are, then, occupied by tamarisk and so  
20 forth.

21 So, taking stage reduction or changes in the U-  
22 shaped channel, up here in the Green River, and trying  
23 to apply those to formation of backwaters down in the  
24 lower part of the river is very, very difficult and  
25 questionable.

1 Q. So, in your opinion, has Dr. Hardy done enough  
2 to be able to conclude that there is a diminimus impact  
3 on the critical backwater habitats downstream?

4 A. You're asking me what's my opinion of that or  
5 what?

6 Q. Yeah. In your opinion, has—you just stated  
7 that it has been—that it's a very difficult question of  
8 what the exact impact will be on all the backwater  
9 habitats downstream from the proposed diversion, right?

10 A. Yes.

11 Q. So, in your opinion, has Dr. Hardy done enough  
12 to answer that question and conclude that it is a  
13 diminimus impact?

14 A. Well, from a scientific basis, absolutely not.  
15 I might have my feeling about things, about something  
16 that looks better than this or that and thus. So, if  
17 we're talking about the numbers of fish, their sizes,  
18 their ability to survive, get enough food to make it  
19 through the winter and all those different things that  
20 has to go into making a decision like that, I don't see  
21 where any work was done and I don't see where any work  
22 of anybody else was used to make this decision about  
23 there's not an effect.

24 I think the term diminimus, here, is being used  
25 out of context, or something, but I'm a scientist. I'm

1 used to seeing numbers. I'm used to trying to figure  
2 out what it means and you don't do science by just  
3 sitting around a gauge in the upper part of the river  
4 and just speculating on what might happen to the flow.  
5 There's too much at stake, from my perspective, for me  
6 to be able to do that. I would not do that myself.

7 Q. In your experience, are you aware of any  
8 endangered fish that have ever been de-listed from the  
9 endangered species?

10 A. Have ever been what?

11 Q. De-listed, taken off the endangered list,  
12 pardon me.

13 A. Well, let me say, first of all, there are  
14 about 150 fish species listed by the endangered species  
15 act as either endangered or threatened. There are  
16 other groups that have been looked at, that are foreign  
17 species, and, then, there are other—some of the salmon,  
18 the Pacific Salmon, have distinct population units just  
19 also under the Act, but let's focus on those 150  
20 species or sub-species of fish.

21 Over the years, there's been four species of fish  
22 removed from the list. Three of those are fish that  
23 went extinct. The fourth one was a mistake. Listed in  
24 error. So, if you take a look at what we've got to  
25 show for our recovery efforts, they're more likely to

1 go extinct than to be recovered.

2 Q. In other words, despite ongoing recovery  
3 efforts, these are still extremely sensitive species,  
4 in your opinion?

5 A. Well, I think it's like we say, well, that's  
6 just a fish. That's not important and we think about  
7 protecting a life history stage, like an adult fish,  
8 and, then, we go on about our business and it doesn't  
9 work. I think we just simply haven't done a good job  
10 of trying to recover fish and part of the reason is  
11 because we let our habitat be destroyed and nibble and  
12 dabble away that we don't have any more.

13 It's quite clear, from looking at a map of dams  
14 and diversions, that almost the entire Lower Basin, the  
15 main stem of the rivers, have been converted into a  
16 system of dams and diversions and cold tail waters and  
17 it's not until you get into the Upper Basin and you  
18 look at the interconnectedness of the Yampa and the  
19 Green River in the Upper Colorado River, to some  
20 extent, you see that that's the only non-manipulated  
21 section of the river as far as the dams and diversions  
22 go. It's connected. It's connected together and I  
23 just explained, earlier today, how these fish move  
24 hundreds of miles to spawn. So, if you interrupt the  
25 spawning by putting-up a dam or diversion, or if you



1 continue to destroy the habitat without questioning what  
2 we're doing, we're going to lose these fish.

3 Q. You're familiar with—I know we've discussed  
4 the Flaming Gorge record of decision in 2006—

5 A. Yes.

6 Q. -after we purchased the operating plan,  
7 correct?

8 A. Yes.

9 Q. And you're aware that there's been testimony  
10 presented at this trial that, under that, Flaming Gorge  
11 will simply release any necessary flows to make up the  
12 difference in the diversion. You're aware that that's  
13 been proposed here?

14 A. I'm not aware that's been proposed.

15 Q. Sorry. You're aware that there's been  
16 testimony to that effect here?

17 A. Well, you just told me there was.

18 Q. In your experience with the operation of  
19 Flaming Gorge Dam, and your interactions with Fish and  
20 Wildlife Services, is it your understanding that the  
21 2006 ROD compels the Bureau to simply release  
22 additional flows to make up for any new diversions?

23 A. Absolutely not. I worked with the Bureau of  
24 Reclamation for many years. In spite of the fact they  
25 didn't really have a very good way of operating the

1 dam, and changed their operating procedures in a  
2 haphazard fashion, they've done a pretty good job of  
3 turning that wheel on and off and turning the water  
4 into that and I believe that they are acting in good  
5 faith to provide flows necessary for the recovery of  
6 the fish. I don't think they're acting to try to  
7 provide flows for private development or anything else  
8 like that. If you're suggesting that they would just  
9 simply say do what you want to. We'll give you flows  
10 from Flaming Gorge—is that what you're saying?

11 Q. That has been suggested.

12 MR. WRIGHT: I'll object to that characterization.

13 THE COURT: I'll sustain that objection.

14 MS. SWENSEN: Okay.

15 A. I'm just asking the question. I wasn't—

16 MS. SWENSEN: It's not you.

17 THE COURT: Well, it's not you. Okay? It's not  
18 you, Dr. Tyus.

19 A. Okay. I'm sorry if I got you in trouble.

20 MS. SWENSEN: No, you're just fine.

21 THE COURT: No. You did not.

22 MS. SWENSEN: You're just fine.

23 A. I believe that they're acting in good faith  
24 to—and they're required, by law, to do that, to  
25 maintain and to help develop the critical habitat

1 region and to protect the fish from things like takings  
2 and that. So, I guess, I wouldn't characterize their  
3 2006 decision in that way.

4 Q. Let me ask it this way. Does your knowledge  
5 or your understanding of the 2006 decision reassure you  
6 or give you confidence, as a scientist, that the  
7 proposed diversion will not have a negative impact on  
8 the endangered fishes in the river?

9 A. No.

10 Q. Thank you.

11 A. I don't understand that. I guess, I would  
12 like to know where all this water is going to come  
13 from. I know that, sometimes, we have a difficult time  
14 of getting the Bureau to cooperate because they don't  
15 want to lose any water. I could tell a story about  
16 what happens in Utah when you take somebody else's  
17 water without—I won't do that, but it's a very serious  
18 thing and I think they're trying to protect people from  
19 flooding and trying to provide water for development  
20 and they've got a big job. I don't think they're  
21 running around trying to provide water for projects  
22 that haven't even come online yet. I'm not so sure  
23 what would happen under a case like that.

24 Q. Thank you.

25 MS. SWENSEN: I have nothing further at this time.

1 MR. MABEY: Counsel David Wright has gone for a  
2 break. He'll be right back.

3 MS. SWENSEN: I didn't plan it that way. I didn't  
4 realize he had stepped out.

5 THE COURT: I didn't either. We're not at a point  
6 where we could take a lunch break.

7 MR. MABEY: No. He'll be right back. He just had  
8 to, you know?

9 THE COURT: I know.

10 DR. TYUS: I'll answer some more questions, if you  
11 have some.

12 THE COURT: Do you need a drink of water, Sir, or  
13 something?

14 DR. TYUS: Sure. I could use that. Thank you.

15 THE COURT: Mr. Wright, cross-examination?

16 MR. WRIGHT: Good timing, or what?

17 MS. SWENSEN: Close.

18 DR. TYUS: Now, see? This is valuable water.

19 THE COURT: Very useful. Thank you.

20 DR. TYUS: Police Officer giving us this water.

21 CROSS-EXAMINATION

22 BY MR. WRIGHT:

23 Q. Good afternoon, Dr. Tyus. I want to try to  
24 put some parameters on how we can use water in the  
25 State of Utah and still try to protect the environment,

1 the habitat for the fish that you're describing, okay?  
2 Is there any level of diversion from the Green River,  
3 that you would find acceptable, that would allow the  
4 protection of the fish that you've been talking about?

5 A. I don't know.

6 Q. How do we know that? What do we have to do to  
7 find out how much water can be withdrawn without  
8 harming habitat?

9 A. Well, that's precisely what I've been working  
10 on for the last 20, 30 years, is come up with a way  
11 that we can have all the water we want and all the fish  
12 and the habitat we want and it's pretty difficult.  
13 There are very difficult decisions to be made, but we  
14 need to find out what the impacts might be of a certain  
15 diversion by looking at the habitat, by looking at the  
16 organisms and figuring out, to our best ability, what a  
17 change like that, a diversion or whatever, would do to  
18 them. So, we speculated on about what would happen too  
19 much and, in doing so, we've lost a lot.

20 Q. So, this is a work-in-progress, isn't it?

21 A. Yes, it is.

22 Q. You mentioned—you were asked about some of the  
23 work that Dr. Thomas Hardy did. Do you recall that?

24 A. Yes, Sir.

25 Q. Is that your opinion, that Dr. Hardy was

1 speculating as to the impact on the stream environment?

2 A. Absolutely.

3 Q. Speculating?

4 A. It's all right to speculate.

5 Q. Well, are you saying he took no measurements,  
6 did no analysis of any kind?

7 A. I can't find any. Have you got some? I don't  
8 know.

9 Q. Yeah. Were you here for Dr. Hardy's  
10 testimony?

11 A. Was I here? No. I wasn't.

12 Q. Okay. You testified that—I think you said--  
13 your words were we're. We are not doing enough to  
14 protect the fish as we continue to develop water. Who  
15 is we? Who is not doing a good enough job?

16 A. I think it's all of us. I think we have—some  
17 of us have little appreciation for the intricate life  
18 histories and the things that these fish do and,  
19 others, we don't really care.

20 Q. The Bureau of Reclamation is involved in the  
21 fish recovery program that you've talked about?

22 A. It is. That's right.

23 Q. And you agree that the State of Utah has  
24 committed itself to the recovery program? It's  
25 involved in that process as well?

1 A. The Bureau?

2 Q. State of Utah?

3 A. State of Utah. I'm less aware of the role of  
4 the State of Utah relative to the flows in the river  
5 because most of those flows are generated and patrolled  
6 by the Bureau of Reclamation. I'm not sure what you're  
7 asking me.

8 Q. Well, I just want to know whether you know  
9 whether Utah has—is participating in the recovery  
10 program.

11 A. Yes, they are.

12 Q. Okay. Did you have an opportunity—let me set  
13 it up just so we're clear. There was an administrative  
14 hearing on the change applications that are at issue in  
15 this case. Are you aware of that?

16 A. Yes.

17 Q. And a decision was issued as a result of the  
18 applications and the hearing process. Are you aware of  
19 that?

20 A. Yes.

21 Q. Have you read the—there are two decisions:  
22 one on the San Juan County water right and one on the  
23 Kane right. Have you read those?

24 A. I am aware that the State Engineer was  
25 considering changing point of diversion.

1 Q. Yes.

2 A. And that's what this is all about.

3 Q. Yes, but my question is he actually issued two  
4 written orders. I just want to know if you've read  
5 them.

6 A. I scanned through them. That's not my field,  
7 but yes. I did take a look at them.

8 Q. Okay. You have a binder of exhibits in front  
9 of you. Let me have you refer to a few of those, okay?

10 A. Sure.

11 Q. Turn to Exhibit Number 2. All of the exhibits  
12 are tabbed. Before we talk about the exhibit, in  
13 particular, do you know what an Endangered Species Act  
14 Section 7 consultation is?

15 A. Yes.

16 Q. Tell me what it is.

17 A. Federal agencies are required to assess what  
18 they're doing and, if they are building something or  
19 issuing a permit or license that would affect an  
20 endangered species or in any way destroy or change,  
21 modify critical habitat, they're required to consult  
22 with the U.S. Fish and Wildlife Service to get a  
23 biological opinion.

24 Q. And what is your opinion of that process? In  
25 your mind, is that helpful toward protecting the



1 habitat of the fish in the Green River?

2 A. I think it is. That's the justification for  
3 the Bureau of Reclamation to fund the study I started  
4 out working on in 1979. You've got to get the  
5 information that we needed to make decisions like  
6 what's the impact going to be and how do we avoid it.

7 Q. Okay and do you recall, that in the orders  
8 issued by the State Engineer in this particular case,  
9 that a Section 7 consultation was a condition of the  
10 approval of these applications? In other words, the  
11 State Engineer said to Blue Castle, in order to use the  
12 water as requested, you must engage in Section 7  
13 consultations in connection with your use of the water  
14 should that become necessary?

15 A. Well, I don't remember reading that and I'm a  
16 little surprised because it's not the responsibility of  
17 the State Engineer to tell the federal agencies whether  
18 or not they need to do a consultation.

19 Q. No. My point is you didn't tell the Bureau  
20 that? The State Engineer ordered Blue Castle, the  
21 entity that wants to divert and use the water, it must  
22 engage in those consultations in the event those  
23 consultations are triggered under the Endangered  
24 Species Act.

25 A. Well, I'm unaware that the Fish and Wildlife

1 Service can consult with a private agency, like Blue  
2 Castle, because it's not a federal agency and only  
3 federal agencies are covered by the critical habitat  
4 consultation.

5 Q. Okay. Well, I'll represent to you, then, as a  
6 fact, that that's exactly what happened, that as a  
7 condition of approval, the State Engineer told Blue  
8 Castle that it has to engage in that consultation.

9 A. Well, the law says it's federal agencies that  
10 are affected and not private agencies.

11 Q. Okay.

12 A. That's the law.

13 Q. Okay.

14 A. So, they're going to have to find an agency  
15 that will consult with the Fish and Wildlife Service in  
16 the action. Now, that's going to be who?

17 Q. I can't answer that. All I'm telling you is  
18 that is simply a fact in this case. So, those  
19 consultations, in your opinion, are they important and,  
20 perhaps, even critical to the continued effort to  
21 protect the endangered fish?

22 A. Yes. I think they are very useful. I think  
23 they are very helpful. I think it's a good way to do  
24 it. In the Upper Colorado River Basin, the recovery  
25 program there has been able to—in working through their

1 consultations, they were able to allow ninety-seven  
2 percent of the water projects to be completed. So, it  
3 hasn't, really, disrupted the development too much, but  
4 it has made some of them a lot more environmentally  
5 sound.

6 Q. Okay. So, in other words, so far, this  
7 consultation process has allowed water to be developed  
8 and still work on keeping the fish safe. Is that fair?

9 A. That's the goal.

10 Q. That's the goal and, in your opinion, is it  
11 working so far?

12 A. We would save more water than we have fish,  
13 I'm sorry to say. So, that's a little bit troublesome,  
14 but I bet we would have lost more fish if we hadn't had  
15 the consultations.

16 Q. Okay. Now, the Green River, you testified,  
17 earlier, that these endangered fish have adapted quite  
18 well to their environment in the Green River. Is that  
19 accurate?

20 A. Yes. I think that's right.

21 Q. And, historically, is it your opinion that  
22 they have endured rather severe and sustained drought,  
23 and I'm talking way back in history, not even in the  
24 last hundred years, but further back than that, there  
25 have been some sustained and pretty severe droughts.

1 Is that right?

2 A. Oh, yes.

3 Q. And the fish have, somehow, managed to survive  
4 that? Evolve to adapt to that? Is that right?

5 A. Well, they're still here.

6 Q. Maybe not as many of them as we want, but  
7 they're still here?

8 A. They're still here, yes. Well, they're not  
9 all still here, excuse me. The Pipe Minnow was  
10 proposed for de-listing by the State of Colorado a few  
11 years ago, but that was denied and, in fact, we find  
12 the populations have declined and, so, we want to get  
13 rid of this endangered status because we don't like it,  
14 but we're finding the fish are slowly declining and  
15 that's a problem because we think about historic things  
16 like--well, there's been droughts, a thousand years ago,  
17 and that sort of thing. There were droughts, but there  
18 weren't introductions of aggressive fishes to compete  
19 and to eat them and there weren't changes in the  
20 habitat in the fashion of travel with the dams and  
21 having diversions and all those fancy things that we  
22 do. We have the capability to do a lot of damage out  
23 there.

24 Q. I agree. You actually anticipated what I  
25 wanted to ask you about next, which is the introduction

1 of the non-native fish into the Colorado River Basin,  
2 generally, and into the Green River. That's a  
3 significant problem for the native fishes, isn't it?

4 A. Yes, Sir. It is.

5 Q. Would you say that it is, perhaps, the most  
6 significant problem that's facing those fish right now?

7 A. Well, I know some very well qualified  
8 ichthyologists that believe that we would not have  
9 endangered fish in the Colorado River today if we  
10 hadn't introduced non-native fishes into the system.

11 Q. What is rotenone?

12 A. Rotenone is a derivative of the derris root  
13 from South America. It's used as a fish toxicant.

14 Q. Do you recall an event, I believe it was 1962,  
15 where the States of Utah and I think it was Wyoming  
16 introduced rotenone into the Green River?

17 A. Yes. It was a very common procedure at that  
18 time, when they were building new impoundments, to kill  
19 the—well, it's either trash fish or suckers and stuff,  
20 some of the chubs and that and the State of Utah,  
21 actually, bought the entire world supply of derris root  
22 rotenone and poisoning out one of the large reservoirs  
23 in the Wasatch Front.

24 Q. And that rotenone, back in 1962, was  
25 introduced into the Green River to try to clean it out

1 and, then, re-stock it with game fish? Is that your  
2 understanding?

3 A. Well, you say into the Green River. It was  
4 introduced into the area to be impounded and not the  
5 river. It wasn't, really, part of the design. I've  
6 read, very carefully, through the documents and I,  
7 pretty well, understand what happened. Their intent  
8 was to simply do a pre-impoundment poisoning and it,  
9 kind of, got away from them a little bit.

10 Q. It did, didn't it?

11 A. Yes.

12 Q. The rotenone made its way down the river and  
13 killed quite a lot of the fish.

14 A. Yes. That's correct.

15 Q. The non-natives that have been introduced,  
16 they compete with the native endangered fish for food,  
17 for cover, for habitat, correct?

18 A. Some of them do. Some of them don't.

19 Q. Sure and, some of them, as you've already  
20 indicated, prey on the native fish.

21 A. Yes, Sir.

22 Q. Do you have an opinion as to how much of a  
23 diversion could be taken out of the Green River that  
24 would not be an unreasonable impact on the Green River?

25 MS. SWENSEN: Objection. Asked and answered.

1 MR. WRIGHT: I don't know that he gave an opinion.

2 THE COURT: He did not give an opinion. He's just  
3 asking if he has an opinion.

4 MS. SWENSEN: Okay.

5 THE COURT: Let's see. The first question was  
6 about fish habitat.

7 MS. SWENSEN: Perhaps I mis-heard this question.  
8 I thought that this question was also aimed at without  
9 an impact. I'm sorry, David. Go ahead and re-state  
10 it.

11 MR. WRIGHT: Yeah. My question is does he have an  
12 opinion—

13 Q. Dr. Tyus, do you have an opinion as to at what  
14 diversion could be taken out of the Green River without  
15 unreasonably impacting the river, the environment of  
16 the river?

17 A. I have a real problem with that question  
18 because of the fact that the system we're dealing with  
19 is changing and when I say, looking at what is going on  
20 today, may not work ten years from now. Can I give you  
21 an example?

22 Q. Please.

23 THE COURT: Go ahead.

24 A. I'd like to give you an example what I'm  
25 talking about.

1 Q. Please.

2 A. In 1987, I think it was, '86, I published a  
3 paper with one of my colleagues looking at what kind of  
4 effect Channel Catfish were having on the system, what  
5 they were eating. Channel Catfish eat almost anything  
6 you can think of. If they were big enough, they would  
7 eat humans, but we found all these different things in  
8 the stomachs of catfish. We went through hundreds and  
9 hundreds of Channel Catfish, looking at their stomach  
10 content.

11 You say what has that got to do with diversions?  
12 We never found any Channel Catfish that had eaten a  
13 crayfish because crayfish weren't in the system  
14 earlier. I go back 15 years later, and we sample.  
15 Every single Channel Catfish that we found was loaded  
16 with crayfish. Now, that may not mean a lot to you,  
17 but we're talking about the food base of the whole  
18 river system has changed. Now, that kind of change is  
19 phenomenal.

20 Q. What river are you talking about?

21 A. The Yampa River, Green River. Fish from all  
22 over the place.

23 Q. Okay.

24 A. So, massive change in the system. We also had  
25 a fellow who did a-



1 Q. Can I ask you just to stop there for just a  
2 second? What caused that change, or do you have an  
3 opinion as to that?

4 A. The non-native crayfish were added to the  
5 system and they proliferated and, now, we have Channel  
6 Catfish doing better, which we don't like, because they  
7 can eat all these crayfish. So, the goal was to try to  
8 keep the water from being warmed-up because the native  
9 fishes are very tolerant of cold water. The Channel  
10 Catfish are not. So, there were some plans to warm up  
11 the water and help the native fish and I had to go and  
12 do the sort of thing and say don't do that. Don't warm  
13 the water up because we're going to have largemouth  
14 bass and flathead catfish and some of these  
15 proliferating eating our fish up. So, that's one  
16 reason why we haven't heard any talk about trying to  
17 warm the river sections up anymore.

18 I'll give you just an example, non-related to your  
19 project, change in the system that we have to, now, go  
20 back and re-do our thinking and figure out how to  
21 better do our job in recovery because it has changed  
22 now. So, you've got a probably changing river system.  
23 That's another reason, if you want to talk about  
24 diversions, why diversions are scary is because we  
25 don't know everything about what happens when you take

1 a small amount of water out, even a large amount of  
2 water out. Obviously, we're arguing about that, but  
3 there will be change. Whether it's good change or bad  
4 change, we'll have to find out. I don't think we're  
5 doing enough work to find out those questions.

6 Q. Will the Section 7 consultations help in that  
7 finding out?

8 A. Well, we, certainly, know a lot more about the  
9 situation now than we did when I started in this  
10 business and it's been very, very, very, very helpful  
11 and the stimulus behind all those studies and the  
12 things that we did came from the consultations.  
13 Whether or not we consult tomorrow and hit the mark,  
14 and have our water, and have our power plants, we would  
15 have our fish and everything and everybody's happy—I'm  
16 sorry if I'm not a little bit--not too optimistic about  
17 that.

18 Q. I understand. The operation, or I should say  
19 re-operation of Flaming Gorge Dam, you understand that,  
20 as of about 2006, the dam is being operated differently  
21 than it was prior to that?

22 A. Yes, that's right.

23 Q. And what they're working on doing is trying to  
24 maintain flows in the Green River in order to protect  
25 the fish and I understand your testimony that you have

1 issues with that, but my point is, simply, that's what  
2 they're working on doing is keeping the flows of the  
3 river higher to do two things: help the fish preserve  
4 their habitat; and, two, allow water to be developed  
5 and used out of the Green River. Is that your  
6 understanding of what they're trying to do?

7 A. Yes, I think so.

8 Q. And would you consider that, so far—how would  
9 you assess the success of that effort so far?

10 A. I don't have any feelings about it or opinion  
11 about that. Let me say that we'll have this idea that  
12 we need more water and, so, we want to raise the flows  
13 up. In certain places, that's the worst thing we could  
14 do because of the fact the fish are adapted to a low  
15 water period and, if you flood out all the backwaters  
16 at the wrong time of year, we've shown, in our studies,  
17 that that just murders the fish. So, we want a more  
18 natural flow regime. I'd like to put it that way and I  
19 believe that they've discussed that, that they looked  
20 at a regime, not just keeping the water level up.

21 Q. Yes. So, in other words, the fluctuations  
22 matter, don't they, to the lives of those fish?

23 A. Well fluctuations, that sounds like an  
24 instantaneous, one-time deal instead of a—

25 Q. Yeah. Maybe that's a bad word, but—

1 A. That's a bad word.

2 Q. How would you characterize it?

3 A. Like I said, some semblance of a natural flow  
4 regime. That's what they're really adapted to.

5 Q. Okay.

6 A. Now, we talked about—I'm sorry. Can I?

7 Q. Please.

8 A. We've talked about the Pipe Minnow and gone  
9 through all its life history. We can sit here and do  
10 the same thing for these other fishes as well. They  
11 have their own life histories, their own different  
12 times of the year, their float needs, their temperature  
13 needs. Putting this all together is a rather difficult  
14 job.

15 Q. I agree with you.

16 A. So, there has to be a little bit of give and  
17 take on this. So, the question you asked me about, if  
18 we had a new depletion, would anything be okay with  
19 you? And that's why I say, you know, we really need to  
20 look at these things before making a decision about it.

21 Q. Okay and I know you know this. You know what  
22 an environmental impact statement is?

23 A. Yes, I do.

24 Q. And you're aware, as part of the process of  
25 seeking a license to develop a power plant, that an

1 environmental impact statement is part of that process  
2 under NEPA?

3 A. Right.

4 Q. Does that give you any higher level of comfort  
5 that, at least, these issues about the habitat for  
6 these fishes will be looked at and evaluated as part of  
7 this process beyond anything that's happened so far?  
8 Beyond anything Dr. Hardy has done in this case? Even  
9 beyond what you have done in this case?

10 A. Well, I actually have taught a class in NEPA  
11 and I was working on environmental impact statements a  
12 long, long time ago with the Corps of Engineers. You  
13 can have good impact statements and you can have bad  
14 impact statements. They're not all good or they're not  
15 all bad, but I think we need to make sure that these  
16 events, these problems or these things that are  
17 happening, that people are aware of them.

18 When I read your notes and information from the  
19 hearing that you had down in Green River, it occurred  
20 to me that your clients knew nothing about the  
21 endangered fish or nothing about critical habitat. No  
22 one mentioned it anywhere and, so, that's pretty  
23 troublesome. I think we need to realize that these  
24 things are going to happen and start working on it.

25 Q. Fair enough.

1 MR. WRIGHT: Nothing further, Your Honor.

2 THE COURT: Re-direct? Oh, excuse me. Ms.

3 Valdes, do you have some questions?

4 MS. VALDES: I do, Your Honor.

5 THE COURT: Go ahead. Take your time.

6 CROSS-EXAMINATION

7 BY MS. VALDES:

8 Q. Hi, Dr. Tyus. My name is Julie Valdes. I  
9 represent the State Engineer in this matter. I think  
10 that you testified that the Section 7 consultations can  
11 only be done with a federal agency. Did I hear you  
12 correctly?

13 A. Well, there are things like pre-listing  
14 agreements and all that sort of thing that can happen  
15 with private agencies as well, but I believe the law  
16 says that—and, really, the Endangered Species Act,  
17 itself. It says that Section 7 is consultation with  
18 other federal agencies.

19 Q. Right and, if this diversion is made, are you  
20 aware that the diversion would be—or, that the power  
21 plant that's created to divert the water would be  
22 licensed through the nuclear regulatory commission.

23 A. No, I'm not.

24 Q. Okay. Would that alter your opinion about  
25 whether the Section 7 consultations were, then,

1 necessary in the order? Or, I'm sorry. That was,  
2 maybe, characterization of your testimony. If the NRC  
3 is involved, would you believe that a condition for  
4 approval, if this were to be approved by this Court,  
5 that the Section 7 consultation would be necessary?

6 A. Will be necessary?

7 Q. Well, helpful to the fish?

8 A. I'm not sure how they would avoid doing one,  
9 at least consulting, to determine whether or not they  
10 need to do an EIS. I would think the first thing that  
11 would be done would be a biological assessment because  
12 that, then, helps you in your planning process.

13 Q. And is that part of the Section 7  
14 consultations?

15 A. It is a first step to getting into the  
16 consultations to do a biological-environmental  
17 assessment or biological assessment, but environmental  
18 assessment is usually where it happens. Excuse me, in  
19 that, what happens is we have a phase called scoping in  
20 which you scope out all the issues that-

21 Q. Well, I'm sorry to interrupt you. I guess,  
22 really, just my question is that if the Nuclear  
23 Regulatory Commission is involved, that that would  
24 trigger Section 7 consultations?

25 A. I would think so.

1 Q. Okay.

2 MS. VALDES: That's all, Your Honor. Thank you.

3 THE COURT: Thank you. Re-direct?

4 RE-DIRECT EXAMINATION

5 BY MS. SWENSEN:

6 Q. All right, Dr. Tyus. I think we're almost  
7 done. You've been very patient with us trying to talk  
8 in scientific terms.

9 A. I've kept it down.

10 Q. Well, I appreciate it. You're talking to  
11 lawyers and you understand, having talked with me. I  
12 appreciate simplification. I just wanted to hit a  
13 couple issues that were raised in the questions that  
14 Mr. Wright asked you.

15 First, he referred to the fact that you're aware  
16 that there have been severe droughts, hundreds of years  
17 ago, and that at least some of the fishes survived. Do  
18 you recall that discussion?

19 A. Yes.

20 Q. Does the fact that fish have survived droughts  
21 over the hundreds of years change your opinion that  
22 they are sensitive to impacts on their habitat?

23 A. No. There's a lot less of them nowadays. The  
24 Pipe Minnow has lost eighty percent of its range. If  
25 it was scattered throughout the whole Basin, from



1 Phoenix all the way up to Vernal or something like  
2 that, there would be droughts through the whole system.  
3 There would be some places that would be all right.  
4 Some places, it wouldn't be all right. There would be  
5 a lot more of a cushion from some of these effects.

6 Q. You talked—speaking of other effects, you  
7 talked with Mr. Wright about the introduction of non-  
8 native species through various means over the years.  
9 You remember talking about that?

10 A. Yes.

11 Q. Would you agree that the introduction of non-  
12 natives has made protecting the critical habitats more  
13 important?

14 A. Yes.

15 Q. Okay. I have one clarification. When you  
16 were talking with Mr. Wright about Dr. Hardy's  
17 analysis, you indicated that you were not aware of any  
18 data. Just clarifying, I think you reviewed Dr.  
19 Hardy's flow measurements at the gauge and that data,  
20 correct, at the Green River Gauge?

21 A. [inaudible] flow measurements at the gauge.

22 Q. I'm sorry. I spoke over you.

23 A. Yeah. You asked me if I am aware he took full  
24 measurements at the gauge?

25 Q. Correct.

1 A. Yes.

2 Q. Okay and, when you said that there was not any  
3 data that you were aware of, were you referring to data  
4 about the specific impact on backwater habitats?

5 A. Yes.

6 Q. Okay. There's been a lot of discussion about  
7 the Section 7 consultation, environmental impact  
8 statements, what may or may not come out during that  
9 process. My question for you is, at this time, based  
10 on the information that you've reviewed from Dr. Hardy  
11 and from the administrative hearing and from Blue  
12 Castle, is there sufficient information for Dr. Hardy's  
13 conclusion that there will be a diminimus impact on the  
14 habitats?

15 A. Not that I can see.

16 Q. And, without that opinion of Dr. Hardy, are  
17 you aware of any scientific basis for concluding, at  
18 this time, that there will be no unreasonable effect on  
19 the stream environment?

20 A. No. I do not.

21 MS. SWENSEN: That's all I have. Thank you.

22 THE COURT: Re-cross?

23 MR. WRIGHT: Nothing further.

24 THE COURT: Ms. Valdes, anything further?

25 MS. VALDES: No. Thank you, Your Honor.

1 THE COURT: Dr. Tyus, thank you very much for your  
2 time today.

3 DR. TYUS: Yes, Sir.

4 THE COURT: I really appreciate it.

5 DR. TYUS: [inaudible]

6 THE COURT: Very good. Ladies and gentlemen, I  
7 think we'll take a break for noon. We want to be back  
8 about 1:15?

9 MR. WRIGHT: Sure.

10 MR. FLITTON: Sure.

11 THE COURT: Thank you all very much. Court is  
12 adjourned.

13 BAILIFF: Please rise.

14 [Recess.]

15 BAILIFF: --State of Utah is now in session, the  
16 Honorable Judge George M. Harmond, Jr. presiding.

17 THE COURT: Please be seated, ladies and  
18 gentlemen. We're on the record in Emery County Case  
19 Number 1207009, Heal Utah, et al. v. Kane County Water  
20 Conservancy District, et al. Counsel are present. Do  
21 you need to wait for Ms. Swensen?

22 MR. FLITTON: No. We're fine, thank you.

23 THE COURT: Mr. Flitton, would you like to call  
24 your next witness?

25 MR. FLITTON: Yes. Thank you, Your Honor.

1 Plaintiffs call Charles Norris to the stand.

2 THE COURT: Mr. Norris, if you would come forward,  
3 Sir, raise your right hand and be sworn.

4 CHARLES H. NORRIS called as a witness by the  
5 Plaintiffs, being first duly sworn, was examined and  
6 testified on his oath as follows.

7 THE COURT: Would you have a seat, please, Sir?

8 DIRECT EXAMINATION

9 BY MR. FLITTON:

10 Q. Could you please state your full name for the  
11 record?

12 A. Charles H. Norris, N-O-R-R-I-S.

13 Q. And, Mr. Norris, could you give us a summary  
14 of your educational experience?

15 A. Yes. I have a bachelor of science in geology  
16 from the University of Illinois, a master's of science  
17 from the University of Washington and Ph.D. work  
18 through a preliminary defense of my thesis from the  
19 University of Illinois.

20 Q. Okay and what is your professional experience?

21 A. I started working as a geologist in 1972 for  
22 Shell Oil Company in the exploration geology  
23 department. I worked in the oil industry for about 15  
24 years for a number of majors and minors and, for a few  
25 years, had my own company. In 1986, I went to the

1 University of Illinois with a non-teaching faculty  
2 position for the laboratory for super computing and  
3 hydrogeology. In 1992, I went back in the private  
4 sphere, first as a [inaudible] hydro geologist for a  
5 company that, at that time, was HSI Geotrans. In 1994,  
6 I believe, maybe '96, I started Geohydro, Inc., which  
7 is a geologic, hydrogeologic consulting firm and I've  
8 been with it ever since.

9 Q. Okay and what have you been retained to do in  
10 this case?

11 A. I was asked to look at the Green River  
12 drainage above Green River Gauge in Utah and assess the  
13 flows in that drainage or patterns of occurrence,  
14 distributions in time and space with respect to what  
15 the existing conditions are and what changes might  
16 occur as a result of the proposed withdrawals for the  
17 Blue Castle facility.

18 Q. Okay and, then, were you also asked to look at  
19 stream conditions below the proposed point of  
20 diversion?

21 A. To the extent that some critical areas in the  
22 Green River, below the potential diversion point, might  
23 be affected by the proposed plant. I was asked to look  
24 at the Green River, down there, from a more logical  
25 standpoint.

1 Q. And what resources did you rely upon in  
2 forming your opinions and making your investigation?

3 A. Overwhelmingly, I relied on USGS gauging data  
4 from the Green River Basin for my understanding and  
5 opinions on the flows, themselves. I discussed, fairly  
6 extensively, with Professor Tyus the issues related to  
7 the endangered species and, particularly, the Pipe  
8 Minnow. I spoke with people at the Bureau of  
9 Reclamation with respect to operation of Flaming Gorge.  
10 Forty years of experience working with ground and  
11 surface water.

12 Q. What about an assessment of the sub-drainages  
13 in the Upper Colorado River Basin?

14 A. In looking at the USGS gauging data, I did not  
15 restrict myself to looking at just the gauge at Green  
16 Rivera and the water passing by Green River. I looked,  
17 as well, downstream at what has been going on, is going  
18 on at Lee's Ferry, the boundary between the Upper and  
19 Lower Colorado Basins and I looked at tributaries,  
20 tributary water to the Utah portion of the Green River  
21 coming in from out of state. So, flows coming in  
22 directly to the Green River from Wyoming and, also,  
23 looking at flows coming in from northwest Colorado, the  
24 Yampa River and the White River.

25 Q. Okay and what is your opinion as to whether or

1 not there's water available to support the diversion to  
2 these water rights?

3 A. There is physical water available at the gauge  
4 at Green River. As the flows in the Green River exist  
5 right now, in the summertime, they are, even since  
6 2006, quite consistently below, and are often  
7 consistently below, the targeted low-flow dry season  
8 flows that the record of decision or the Flaming Gorge  
9 project has, the 1,300 cubic feet.

10 If you consider water coming from other states  
11 that might be going to Lee's Ferry through the Green  
12 River, and make adjustments for that, then, an argument  
13 can be made that there isn't free water available that  
14 doesn't already have a purpose within the Colorado  
15 River Basin system.

16 Q. Okay. Explain that to me a little bit.

17 A. Well, Colorado—all of the Upper Basin states,  
18 collectively, have an obligation to deliver water at  
19 Lee's Ferry for the Lower Basin states. There's an  
20 apportionment of that required water that has been  
21 given to each state, assigned to each state. That  
22 percentage, for example, was used by the State Engineer  
23 in taking the required deliveries times the percentage  
24 that was Utah's to come up with his, roughly, 1.4  
25 million acre feet number and since Wyoming's got an

1 assessment under that appropriation, and Colorado has  
2 an assessment under that appropriation, the Green  
3 River, through Utah, becomes necessary a conduit for  
4 waters from other states to meet the collective compact  
5 requirements at Lee's Ferry and, so, I was curious  
6 that, where the water flowing in the Green River might  
7 be looked at in terms of being there for another state  
8 or, at least, contributing water from another state.

9 Q. You would agree, however, wouldn't you, that  
10 there's flexibility within how some of the Colorado  
11 River Compact are—

12 A. Absolutely. I mean, Colorado is not obliged  
13 to contribute exactly its percentage in any year. It,  
14 certainly, doesn't have to contribute the percentage of  
15 a particular river in a given year. Ultimately, it  
16 falls upon all of the states, collectively, to meet the  
17 obligation at Lee's Ferry and, if that obligation is  
18 met, then, all of the states have to figure out why  
19 that's done and make the adjustments that are necessary  
20 to bring that delivery back up to where it needs to be.

21 Q. And you're familiar with the Upper Colorado  
22 River Commission, right?

23 A. Yeah. I'm familiar with it in its overall  
24 context. I won't claim to be an expert in the legal  
25 interpretations of all of the individual things. I



1 think I have a decent understanding, as a physical  
2 scientist, of what the words mean in terms of water  
3 flows and physics of water and patterns of flows.

4 Q. Okay. So, let's just walk through some of  
5 your findings in terms of the flows at the Green River  
6 Gauge. How many days, on average, did you find that  
7 the flows were below 1,300 second feet?

8 A. I didn't compute average flows. I looked at  
9 two years, specifically. I believe it was 2011, which  
10 was an extremely wet year, and 2002, I think, which was  
11 a very dry year, just to get a range of what it might  
12 be. Both years showed a number of days that the 1,300  
13 wasn't met. The wet year, it was not a tremendous  
14 number of days. A few dozen, I believe, it was. The  
15 dry year had—I think I identified 71 continuous days,  
16 over two months, where it did not meet the 1,300.

17 Q. And did you also look at the gauging station  
18 at Flaming Gorge?

19 A. Yes, I did.

20 Q. Okay. Where is that gauging station located?

21 A. The one I was looking at was the Green River  
22 near Green Gate, I believe it is. It's within sight of  
23 the dam, but it's far enough away that I think it's a  
24 good, average flow in the river and not being subjected  
25 to the specific release, moment-by-moment release

1 differences.

2 Q. Okay and did you do any work to correlate the  
3 flows, the quantities being released at the Flaming  
4 Gorge Dam with the gauge station measurements at Green  
5 River?

6 A. Until the last few days, I haven't made a  
7 tight comparison between the Green River Gauge and the  
8 Flaming Gorge gauge. I did look at the Flaming Gorge  
9 Gauge with respect to calculations by reclamation on  
10 in-flows to the reservoir and noted that those are very  
11 close to each other. The water in and water out is  
12 pretty consistent.

13 Since 2006, when the efforts have been being made  
14 to involve releases from Flaming Gorge to meet the  
15 1,300 low limit, I did look at, this year, 2013, and  
16 noted that the releases from Flaming Gorge, in the core  
17 60 days of summer, were 1,100, quite consistently up  
18 to, maybe, 1,150, or something. So, very steady,  
19 continual release there of about 1,100 CFS and I  
20 compared that to the Green River, near Jensen, Gauge  
21 and the Green River at Green River. The Green River at  
22 Jensen was consistently above 1,300. The Green River  
23 at Green River Gauge was, for the most part, below the  
24 1,300.

25 Q. What are the typical flows that are being

1 released, you know, the range from Flaming Gorge  
2 Reservoir for the numbers you've looked at?

3 A. This year, it's very consistently 1,100 up to  
4 about—it's risen, a little bit, in the last three or  
5 four weeks and it may be up to 1,150 or 1,200, now,  
6 that are being released.

7 Q. Okay and that's at the low flow period of  
8 flows, correct?

9 A. Well, this is the low flow time of year. So,  
10 yes.

11 Q. And I'm going to hand you a couple of  
12 documents.

13 [Inaudible discussion.]

14 MR. WRIGHT: What are the numbers? Do you know?

15 MR. FLITTON: Eighty-five and 86. Eighty-five is  
16 the 2002.

17 MR. WRIGHT: Got it.

18 Q. Okay. Are you familiar with these documents?  
19 Let me just identify them. These documents are marked  
20 85 and Exhibit 86.

21 A. Yes. I am familiar with them.

22 Q. Okay. What is document 85?

23 A. Document 85 is the average daily flows at the  
24 Green River Gauge at Green River, Utah, during year  
25 2002. That would be the heavy blue line. Did you just

1 ask me about 85 or 85 and 86.

2 Q. Let me ask you, first, about 85.

3 A. Okay.

4 Q. Okay. So, the heavy blue line is the physical  
5 flows, correct?

6 A. Yes.

7 Q. Okay and, then, what are the other—I see some  
8 red lines, at least a red line, now, towards the  
9 bottom. What's that?

10 A. Right. The solid red line, right just off the  
11 bottom of the graph, is a line representing 70 CFS,  
12 which is one of the numbers that's been used for the  
13 amount of water that would be used by the proposed  
14 plant.

15 Q. Okay and, then, this dashed line that's  
16 further up?

17 A. The dashed line is, essentially, the minimum  
18 low flow, low year, target for protecting the fish  
19 habitats and the fish.

20 Q. Okay. So, that's the 1,300 second feet?

21 A. That's the 1,300, yes.

22 Q. Okay and, then, the green line, what does that  
23 represent?

24 A. The green line is the blue line, the actual  
25 flow, reduced by water coming from Wyoming in the Green

1 River and water coming from the Yampa and White Rivers  
2 in Colorado.

3 Q. So, would it be fair to say that—is that an  
4 approximation of the return flow waters that those  
5 states would be obligated to? Fair to say it that way?

6 A. It is for Wyoming. It is an approximation for  
7 the Yampa and White if Colorado actually allowed them  
8 to be developed to the extent that Colorado still has  
9 water available for appropriation. Those rivers are  
10 under appropriated. So, 1.6 million on an annual basis  
11 for the most recent ten years would be, nominally,  
12 Lee's Ferry water; .4 million is water that could very  
13 conceivably, at some point, be consumed by Colorado.

14 Q. And, then, the same lines have the same  
15 representations on Exhibit 86?

16 A. That's correct.

17 Q. Okay and, so, that one is showing a wet year?

18 A. That's a wet year, yes.

19 Q. Okay, but there were still days, it looks  
20 like, that the—well, let's see—that the available flows  
21 would fall below.

22 A. Below 1,300.

23 Q. Yeah.

24 A. Yes.

25 Q. Okay.

1           A. And, apparently, I left the 1,300 line off  
2 that.

3           Q. Second one? So, going back to—

4           A. Actually, I need to correct myself in looking  
5 at this. The 1,300 was not broken in 2011.

6           Q. In 2011?

7           A. There were days under which, if you used the  
8 green line, that there would not be unappropriated  
9 water at the 70 CFS.

10          Q. Okay. So, in 2011—

11          A. Right.

12          Q. —the physical flows of the river, at that  
13 gauge, they were above 1,300 second feet?

14          A. They were above 1,300 second feet.

15          Q. Okay, but in the drought year of 2002, I think  
16 you said 71 days?

17          A. The big period from about mid-July until mid-  
18 September was continually below the 1,300.

19          Q. But is it your opinion that there's a  
20 difference between physical flows and available flows?

21          A. Well, yeah. There's—the whole premise is—I  
22 understand water law in the west is just because  
23 there's water in a creek or a lake or a river doesn't  
24 mean anybody can take it out. Just because it's  
25 flowing past them doesn't mean it's available to them.

1 If that water is committed, appropriated, to somebody  
2 downstream, that water can only—you can't consume that  
3 water. It has to be sent downstream.

4 So, expanding that, in a slightly modified case  
5 of different states having certain obligations and  
6 rights to water, you can look at a river, like the  
7 Green, that states have to use to deliver their water  
8 to Lee's Ferry, you can look at it from the narrow,  
9 instantaneous position that, if that river has to be a  
10 conduit, and if it has to convey another state's water,  
11 then, that water should be given at least, maybe not in  
12 a given year, but overall, that water has to be  
13 delivered to Lee's Ferry in some way or another, either  
14 through the Green River or somewhere else.

15 So, if you apportion it by way of the Green River,  
16 then, it, really, isn't available to Utah. It can be  
17 looked at as Colorado water that has to go down river  
18 and, under that scenario, there isn't physical water at  
19 Green River to be used.

20 Q. Let's talk about—

21 A. I'm sorry, there isn't available water to be  
22 used.

23 Q. Let's talk about the work you did on looking  
24 at the stretch of the river downstream of the gauging  
25 station. What, exactly, did you do there?

1           A. What I was investigating and looking at,  
2 there, was based upon some of the materials supporting  
3 the re-location of the water rights, some of the  
4 studies that were done and some of the testimony that  
5 was given at the administrative hearings related to the  
6 applications for change that suggested that the Green  
7 River Gauge could be looked at in terms of gauge  
8 differences at that location being indicative of-or,  
9 changes to the river at that gauge being indicative of  
10 changes to the river downstream where the Pipe Minnow  
11 nurseries are.

12           So, I looked at historical air photos from Google  
13 Earth under the full range of records that were there,  
14 looking at the section of the Green River at the gauge  
15 and sections of the Green River where the nurseries are  
16 and I think there was pretty close to a ten-fold  
17 difference in flows that had been photographed from  
18 lows of about a thousand to lows up to about 10,000  
19 cubic feet per second and, as the investigation of the  
20 Colorado-not the Colorado, the Green River, at Green  
21 River, indicated, there was no discernible difference  
22 in the river at that location over any of the flow  
23 differences. It, basically, was the same physical  
24 width and the GS data showed that the width did not  
25 change appreciably during even much larger flow changes



1 than that.

2 When you looked down river at the nursery area  
3 below the San Rafael River, there were dramatic  
4 differences in the river, flow conditions over that  
5 range of flow. Under high flow, the rivers were not—  
6 they did not flood out all of the point bars and  
7 accretionary features, but the river, basically, filled  
8 all but the biggest [inaudible] features in the valley  
9 bottoms. At low flows, there was much more emergent  
10 accretionary features, sand bars, spits, islands and  
11 also were visible backwater areas during the low flow  
12 condition.

13 So, it offered photographic evidence of what Dr.  
14 Tyus had talked to me about and also what intuitively  
15 one is going to know who has worked on rivers and  
16 walked them is that very low, very small, changes in  
17 flow can have large aerial impacts in terms of what's  
18 flooded, what isn't flooded and whether you have areas  
19 that have very shallow water, but still interconnected  
20 water, as opposed to dry banks and the concept that you  
21 can look at a change to a river at a gauging station,  
22 where the river is confined to a narrow channel, and  
23 postulate that a calculated change, there, of somewhere  
24 between one and two inches is going to have a  
25 comparable change in an entirely different regime in

1 the river is, quite frankly, nonsense.

2 One and a half inches at the gauging station at  
3 Green River has very little change. You take 70 CFS  
4 off 1,000 CFS or 1,300 CFS, there, and you're not going  
5 to see a noticeable change, but if you go down to where  
6 you have bars and spits and islands in the river, that  
7 same flow reduction can have a much greater impact.  
8 It, certainly, can't be dismissed as insignificant  
9 because it was insignificant in an entirely different  
10 type of channel.

11 Q. So, you would disagree with Dr. Hardy's  
12 assessment that the impacts would be diminimus  
13 downstream?

14 A. He has no evidence that they would be. The  
15 projection of what, arguably, might be diminimus at the  
16 gauge position is irrelevant to what's going to be  
17 happening down in the nursery area. I've not been to  
18 the nursery. I haven't prowled around it for years. I  
19 haven't worked with the critters there. I, certainly,  
20 would defer to Dr. Tyus to describe what those impacts  
21 are, but there is no basis to project what might be,  
22 arguably, diminimus at the Green River gauge as being  
23 diminimus in the nursery area.

24 Q. I'm going to give you a couple of photographs  
25 to identify. You've been handed a set of documents

1 marked Exhibits 88, 89-

2 MR. WRIGHT: Can you help me out? I don't know  
3 which is which.

4 THE COURT: Which is which?

5 MR. FLITTON: Okay. Yeah. Let me-  
6 [Inaudible discussion.]

7 Q. Okay. So, the first document, document 87, is  
8 the high flow downstream Green River?

9 A. High flow at the-

10 Q. Yeah, high flow at-okay. Eighty-seven is the  
11 high flow of Green River Gauge. Eighty-eight is low  
12 flow at Green River Gauge. Eighty-nine is high flow  
13 downstream and-

14 A. I don't have low flow at the gauge.

15 Q. You don't have low flow at the gauge?

16 A. Do you have four documents?

17 Q. Yeah. You should have all of them. Here,  
18 take that.

19 A. Thank you. Eighty-eight is low flow at the  
20 Green River Gauge?

21 Q. Yes.

22 A. What's 89?

23 Q. Eighty-nine is high flow, downstream.

24 A. And 90?

25 Q. Is high flow-or, low flow downstream.

1 A. Thank you.

2 Q. So, let's start with document number 87.

3 MR. WRIGHT: Well, hold on a second. I don't  
4 think I've got what you've got. Okay. I've got high  
5 flow at the gauge.

6 MR. FLITTON: That's 87.

7 MR. WRIGHT: Eighty-seven? No. You said—July  
8 13th. So, there's two of them.

9 MR. FLITTON: I know. Eighty-seven is this one.

10 MR. WRIGHT: Those are the same.

11 MR. FLITTON: No, that's downstream.

12 MR. WRIGHT: Oh, sorry. Sorry. Downstream.

13 MR. FLITTON: So, 87.

14 MR. WRIGHT: Eighty-seven.

15 MR. FLITTON: Eighty-eight.

16 MR. WRIGHT: Eighty-eight.

17 MR. FLITTON: Eighty-nine.

18 MR. WRIGHT: Eighty-nine.

19 MS. VALDES: Wait, wait, wait. Eighty-eight is—

20 MR. FLITTON: So, it goes high flow and, then, low  
21 flow. So, you start Green River high flow, then, low  
22 flow.

23 MS. VALDES: Both of those are low flow at Green  
24 River Gauge on the same date.

25 MR. FLITTON: Okay.

1 MS. VALDES: Oh. I think it's here. Downstream?

2 MR. FLITTON: Yes.

3 MS. VALDES: Can I get one of those back? Thank  
4 you.

5 MR. FLITTON: That took a lot. Sorry.

6 Q. Okay. So, document number 87. Do you have  
7 that in front of you?

8 A. Yes.

9 Q. Okay and this is a document that you provided  
10 from Google Earth of the photo?

11 A. Yes.

12 Q. And, so, this one is showing what?

13 A. This was a period of a photograph on Google  
14 Earth from a period that corresponded to gauged high  
15 flow on the Green River. So, it's high flow in the  
16 Green River at the Green River Gauge.

17 Q. Okay and, then, document number 88 is what?

18 A. Eighty-seven is also dated July 13, 1997.

19 Q. Okay.

20 A. Eighty-eight is the same area being shown in  
21 this case. It was a photograph that is September 14,  
22 2004, and it is a period, on the day that that  
23 photograph was taken, that there was low flow in the  
24 Green River on that day.

25 Q. Okay. So, did you use these two photos for

1 comparison purpose?

2 A. Yes.

3 Q. Okay and what was that comparison?

4 A. Well, the river, at the gauge position and the  
5 gauge position latitude and longitude listed by the  
6 USGS on its website, as indicated by the yellow pushpin  
7 on the photograph. The river at that gauge position  
8 is, essentially, identical looking between those two  
9 dates. In looking at the photo at the position of the  
10 gauge, you would not look at one and go, oh, that's  
11 high water as opposed to low water and this was not an  
12 inch or an inch and a half of change or a 70 CFS  
13 versus—or, I mean, a 1,230 versus a 1,300 CFS flow  
14 change. This would be a change that was, say, in the  
15 low flow area, perhaps 1,000 CFS and, probably, 8,000  
16 CFS at the high flow. So, these are dramatically  
17 higher flows and the photograph, the river in the  
18 vicinity of the gauging station, where diminimus  
19 hypothesis was created, is not capable of showing a  
20 major change.

21 If you look up river, there was another bridge  
22 just at the top edge of each of these two photographs  
23 for 88 and 89 and, there, you can see, in the low flow,  
24 islands clearly emergent during the low flow time  
25 period that are almost entirely inundated during the

1 high flow period.

2 So, where you have features like islands and bars  
3 and spits, backwaters, they show a different river  
4 characteristic than does a confined channel which was  
5 selected for the USGS gauging station.

6 Q. Okay and that's the spot where the Hardy  
7 calculations were made, correct?

8 A. The Hardy calculations are based on the tables  
9 that are generated for the gauging station in terms of  
10 average width, average—I mean, the width, the  
11 thickness, the average velocity over the different  
12 steps in flow. So, that was what was used to generate  
13 the curves that were used to project a 1.4 or 1.5,  
14 whatever the number was, change for 70 CFS during a low  
15 flow condition.

16 Q. Okay. Then, let's identify Exhibits 89 and  
17 90.

18 A. Okay. Eighty-nine and ninety are the same  
19 river meander downstream of the Green River Gauge,  
20 downstream of the San Rafael River. It's a meander in  
21 the vicinity of—in the range of river that is  
22 identified as being within the nursery area. These  
23 pictures are dated the same as July—yeah, July 13,  
24 1997, is a black and white that is high flow of the  
25 river. On July 13, 1997, and the photograph of

1 September 14, 2004, represents the low flow.

2 Q. Okay.

3 A. It is a projection of high and low flow based  
4 on the gauge at the Green River Station because there  
5 is no gauge down here. There could be some lag between  
6 the exact highest and lowest conditions, but the  
7 magnitude of the flow differences are enough that, if  
8 you have high water upstream, you would still be having  
9 high water downstream as well.

10 Q. And a comparison of these photographs is the  
11 same as above, that it shows the differences in the  
12 stream?

13 A. Yes and, in particular, I would call your  
14 attention to the emergent body of sediment just to the  
15 left of the pushpin on figure 90, the low flow that is,  
16 essentially, completely under water in the high flow.  
17 It's one of the most clear changes that you can see in  
18 this channel is it has become emergent as the water has  
19 dropped out.

20 Q. Okay.

21 MR. FLITTON: That's all the questions I have.  
22 Thank you.

23 THE COURT: Thank you, Mr. Flitton. Mr. Wright,  
24 cross-examination?

25 MR. WRIGHT: Yes, Your Honor.



1 CROSS-EXAMINATION

2 BY MR. WRIGHT:

3 Q. I'm sorry, Mister or Doctor?

4 A. Mister.

5 Q. Mister. Mr. Norris, would you please open the  
6 exhibit binder in front of you to tab 6 and page--first  
7 of all, do you recognize or know what this document is?

8 A. Yes. It's one of the two orders for  
9 withdrawal change, location changes for the water  
10 rights.

11 Q. Have you read both of them?

12 A. Yes.

13 Q. Recently, say?

14 A. Probably not in the last month.

15 Q. Okay. Turn to page 5--I'm sorry, page 4. The  
16 second full paragraph states that, to date, the upper  
17 basin states have met all of their downstream  
18 obligations under the Compact and law of the river and  
19 you know, by Compact, we're talking about the Colorado  
20 River Compact?

21 A. Yes.

22 Q. It is estimated that Utah water users  
23 currently deplete approximately one million acre feet  
24 annually which represents an underutilization of Utah's  
25 share of the Colorado River allocation. Do you agree

1 or disagree with that statement? I asked you two  
2 statements, there, to be fair.

3 A. Uh-huh [affirmative]. I really don't have an  
4 opinion one way or the other on that. I don't know  
5 what Utah utilizes. So, I don't know whether that  
6 statement is accurate, whether it utilizes a million  
7 acre feet or not.

8 Q. Do you agree it comes from a reliable source,  
9 the Utah State Engineer?

10 A. I would certainly think the Utah State  
11 Engineer would know that, yes.

12 Q. Turn to page 5. Under the heading on that  
13 page, right in the middle of the page, summary of  
14 investigation. Do you see that?

15 A. Yes.

16 Q. It states that the Green River in the vicinity  
17 of the City of Green River, Utah, has never been  
18 regulated by priority due to a shortage of water. Do  
19 you understand what that statement means, regulated by  
20 priority?

21 A. Yes. At least my understanding would be that  
22 the water in that river has never fallen to the point  
23 that someone who owns a junior right has had to curtail  
24 their take because there wasn't enough water for both  
25 the junior and the senior person to take the water.

1 Q. Exactly. That's exactly what it means. The  
2 annual mean flow of the Green River, as measured at the  
3 USGS station, etc., etc., for the full historical  
4 record of the station, years 1895 and '99 and 1906 to  
5 2010, is 6,048 CFS. That's the annual mean, with an  
6 annual mean volume of 4.381 million acre feet. Do you  
7 have any reason to disagree with either of those  
8 figures?

9 A. No reason to disagree or agree. I've not  
10 analyzed the data in that sense.

11 Q. Yeah, but there's some reason to agree. It  
12 comes from a reliable source.

13 A. Again, I would presume that whoever the State  
14 Engineer had run those calculations are likely to be  
15 correct, but—

16 Q. Have you done any analysis of diversions from  
17 the Green River? In other words, authorized water uses  
18 from the Green River?

19 A. No.

20 Q. Did you read that part of the State Engineer's  
21 order where that was actually done?

22 A. I read where that was discussed. I didn't  
23 look at it in a great deal of detail.

24 Q. How much water, if you could quantify it for  
25 me, please, how much water is Wyoming required to

1 deliver to the Lower Basin states?

2 A. I don't have my expert report with me. It is  
3 on the order of, I think, a million, less than a  
4 million and a half.

5 Q. Where do you get that—you're talking about  
6 acre feet?

7 A. Yes.

8 Q. Where do you get that figure?

9 A. That is the Wyoming proration times the seven  
10 and a half or six and a half?

11 Q. Seven and a half.

12 A. Seven and a half.

13 Q. So, you're talking about the Lower Basin this  
14 year?

15 A. Yeah, the Lower Basin.

16 Q. Yeah, seven and a half.

17 A. Their percentage times the seven and a half.

18 Q. So, that's how you calculated? You took  
19 Wyoming's share under the Colorado River Compact,  
20 deduct out a portion for the Lower Basin states.  
21 That's the volume?

22 A. For some reason, without looking at my expert  
23 report, right now, I'm—

24 Q. You're welcome to, if you need to refresh your  
25 memory. I'm not trying to—

1 A. Right. I really would like to because—

2 Q. Sure.

3 [Inaudible discussion.]

4 MR. WRIGHT: Your Honor, we're not offering it as  
5 an exhibit.

6 THE COURT: Right.

7 MR. WRIGHT: Just to refresh.

8 A. All right. The—

9 Q. Could you tell me where, in your report,  
10 you're looking to refresh your recollection, please?

11 A. Yeah. I'm looking, first, at page 5.

12 Q. Okay, I'm there.

13 A. In the last paragraph, there, where I'm  
14 partitioning the hypothetical flow at Lee's Ferry, the  
15 hypothetical, natural flow where there's seven and a  
16 half million acre feet that go to the Lower Basin, one  
17 and a half million acre feet that goes to Mexico and,  
18 so, that there is six million that's allocated among  
19 the Upper Basin states and I think that's by the—that  
20 apportionment comes from the Upper Colorado River Basin  
21 Compact and I read that to be that that is exclusive of  
22 both of those two flows that are involved.

23 So, it's times six million and, so, my  
24 understanding of the Utah flow is twenty-three percent  
25 of the six million, or 1.37 million acre feet.

1 Q. You understand the Utah State Engineer uses a  
2 figure of 1.4 for Utah's share?

3 A. Yeah. The two significant digits, it's the  
4 same number I've got.

5 Q. Yes, but we are talking about water. So,  
6 every drop matters, right?

7 A. Yeah. We, probably, should be going to six  
8 significant digits. Now, I'm looking for where I have  
9 the Colorado number or the Wyoming number.

10 Q. Either one would be fine. I'm going to ask  
11 the same question as to both states. I want to  
12 understand how you quantify how much Wyoming has to let  
13 go or Colorado has to let go to the lower basin.

14 A. Right. Okay, on page 14-

15 Q. Of your report?

16 A. Yes.

17 Q. Okay.

18 A. The apportioned annual amount to Wyoming is  
19 fourteen percent, which would be the 1.0643 under the  
20 conditions of a natural delivery of 16 million acre  
21 feet.

22 Q. Is there a place in either the Compact or the  
23 Upper Basin Compact that I could look to to determine  
24 those figures for Wyoming's obligation to the Lower  
25 Basin or Colorado's obligation to the Lower Basin?

1           A. I believe it would be in the Upper Colorado  
2 River Basin document.

3           Q. Okay. I've got that if you would like to-  
4 would that be helpful?

5           A. Yeah. I don't have a copy of it and I  
6 certainly haven't memorized it.

7           Q. Okay. I will-it starts there. It's just,  
8 kind of, a summary of the contents and, then-

9           A. All right. The percentages that I was using  
10 comes from Article 3A(2).

11          Q. Right. Both Compacts speak in terms of  
12 percentages. Do they not?

13          A. Pardon?

14          Q. In terms of allocations, the Compacts speak in  
15 terms of percentages, the allocations to the states?  
16 Utah gets 23 percent.

17          A. The Upper Colorado River Basin Compact does.  
18 The Colorado Compact that talks in terms of specific  
19 yield requirements that were based on an assumed  
20 natural flow to the Basin at that time-

21          Q. Right.

22          A. -I don't recall that the Colorado Compact  
23 allocates anything on a state-by-state basis. I may be  
24 wrong, but-

25          Q. Let me-maybe I confused you. Okay. The

1 Compact identifies Upper Basin share and Lower Basin  
2 share, the Colorado River Compact.

3 A. Yes.

4 Q. Correct?

5 A. Yes.

6 Q. Seven and a half million up, seven and a half  
7 million down?

8 A. Right.

9 Q. Right? The upper is the one that identifies  
10 the percentages.

11 A. Correct. That's my understanding.

12 Q. Okay. There might be another way to go about  
13 this. Let's look at the exhibit that you discussed.  
14 Let's start with Exhibit 86. It's your hydrograph. Do  
15 you have that?

16 A. Yes.

17 Q. You speak, here, in terms of physical flow  
18 versus available flow and I think what I heard you say  
19 is, in order to evaluate or determine available flow--  
20 and just so we're clear. Eighty-six is a wet year.  
21 Exhibit 85 is a dry year.

22 A. Yes.

23 Q. Okay, but in terms of what you're depicting,  
24 it's the same idea; which is you're trying to identify  
25 how much water is actually available to Utah in the



1 Green River?

2 A. Yes.

3 Q. Okay and you did that by deducting—I think I  
4 heard you say you deduct-out the tributaries?

5 A. I deduct-out the tributaries to the extent  
6 that they are conveying out-of-state water to the  
7 Green.

8 Q. The Yampa and the White?

9 A. The Yampa and the White from Colorado and the  
10 Green River from Wyoming at the Wyoming border.

11 Q. Okay. Why would you—in order to figure out  
12 how much water is available in a river, why would you  
13 take out tributaries to that river?

14 A. The waters that are tributary I looked at as  
15 either obligations of that state to the Compact at  
16 Lee's Ferry or as water that, under that state's  
17 jurisdiction, it could allow somebody else to use. So,  
18 in the case of Wyoming, what's being released by  
19 Flaming Gorge is pretty close to what Wyoming's  
20 obligation is. So, that, I looked at as being water  
21 that need be passed on in order to allow Wyoming to  
22 meet its requirements.

23 At the White and the Yampa, 1.6 million—excuse me,  
24 acre feet of the two million average over the last ten  
25 years would be a proportionate intra-Colorado

1 apportionment of—if you compare the three big rivers  
2 coming out of Colorado serving the Compact, the San  
3 Juan, the Colorado and, then, the combined northwestern  
4 rivers, the Yampa and the White, if you pro-rate  
5 Colorado's proration based on drainage areas, you come  
6 up with about 1.6 million that would be coming out of  
7 those rivers that would be destined for Lee's Ferry and  
8 .4 million that would be available for development in  
9 Colorado not currently being—

10 Q. So, is the bottom line that Utah simply cannot  
11 count on any water out of the Yampa?

12 A. So long as Colorado is not using any of its  
13 undeveloped water, and it can be, but it is water that  
14 Utah, unless it can replace it with water somewhere  
15 else, had better not count on using in perpetuity  
16 because Utah wouldn't have control over that water in  
17 the future. Today, it would be water that would be  
18 available, but in long-term, under the assumptions I  
19 made of partitioning Colorado's water, there's no  
20 reason to think it would be there indefinitely.

21 Q. Well, be careful because you're aware, under  
22 the Upper Basin Compact, Utah is guaranteed half a  
23 million acre feet of water out of the Yampa and I would  
24 be happy to read you that language. Do you disagree  
25 with that?

1 A. I am unaware of that and if that's-

2 Q. Let me just read a section from Article 13 and  
3 you can disagree on what it means. Subject to the  
4 provisions of this Compact—I'm reading from Article 13  
5 of the Upper Basin Compact. Subject to the provisions  
6 of this Compact, the rights to the consumptive use of  
7 the water of the Yampa River, a tributary entering the  
8 Green River in the State of Colorado, are hereby  
9 apportioned between the states of Colorado and Utah in  
10 accordance with the following principals: (A) the  
11 State of Colorado will not cause the flow of the Yampa  
12 River at the Maybell Gauging Station, to be depleted  
13 below an aggregate of five million acre feet for any  
14 period of ten consecutive years reckoned in continuing  
15 progressive series, beginning with the first day of  
16 October next succeeding ratification approval of this  
17 Compact. Take five million acre feet, spread it over  
18 ten years, an average of 500,000 acre feet per year.

19 So, in any ten-year period, Utah is guaranteed  
20 five million acre feet out of the Yampa. Can we agree  
21 on that?

22 A. That is what that would say, I believe.

23 Q. You testified about the flows from Flaming  
24 Gorge since 2006 and I believe you testified that,  
25 since that time, the releases have been in the 1,100

1 CF—I'm sorry. The flows have been in the 1,100 CFS to  
2 the 1,150 CFS range?

3 A. If you heard that, I may have misspoken.

4 Q. Okay, correct me.

5 A. That was this summer's flows over 60 days of  
6 low flow period.

7 Q. Okay. Do you know what the flows have  
8 typically been since '06 when they started re-operating  
9 Flaming Gorge?

10 A. I have not looked at that in any detail in  
11 terms of instantaneous daily flows.

12 Q. Okay. Were you here for Kent Jones'  
13 testimony?

14 A. No.

15 Q. He testified that, since '06, the flows have  
16 been within, sort of, what has become the accepted  
17 margin of error, twenty-five percent or so, of that  
18 1,300 CFS, more or less consistently since that time.

19 MS. SWENSEN: Objection. Sorry.

20 MR. WRIGHT: Do you have a reason to disagree with  
21 that?

22 THE COURT: Just one second. What's your  
23 objection?

24 MS. SWENSEN: I believe that mischaracterizes Mr.  
25 Jones' testimony. He testified that his understanding

1 was they had intended, since the 2006 record of  
2 decision, to operate the dam in a way to maintain those  
3 flows. I don't recall, in the data specifically  
4 submitted by the State Engineer, that there was data  
5 past 2004, in fact, in that exhibit discussed by Mr.  
6 Norris.

7 MR. WRIGHT: No. I'm not talking about an  
8 exhibit, Your Honor.

9 THE COURT: You're talking about his testimony.

10 MR. WRIGHT: I'm talking about his live testimony  
11 where he stated that the flows have been eleven eleven-  
12 fifty range, more or less, within that margin of error,  
13 since '06.

14 THE COURT: I can't hold my finger on that.

15 MR. WRIGHT: I'll withdraw it. It's not that  
16 important. It's in the record.

17 THE COURT: Okay.

18 Q. Have you done any analysis or study to assess  
19 the significance of a reduction in channel flow of 70  
20 CFS on the Green River at any reach below the proposed  
21 point of diversion or any section of the river below  
22 the point of diversion?

23 A. No, I have not.

24 Q. What is sinuosity in a river?

25 A. The degree to which the river meanders or

1 changes course.

2 Q. And did you do any calculations concerning  
3 sinuosity in the river section before or after a 70 CFS  
4 reduction is proposed in these applications?

5 A. No.

6 Q. I take it, correct me if I'm wrong, that you  
7 don't dispute Dr. Hardy's measurement of, say, an inch  
8 or an inch and a half change in width or stage or  
9 whatever those figures were. Your disagreement is an  
10 inch and a half, or whatever the value is, might mean  
11 something different in one piece of the river than it  
12 does at this piece of the river.

13 A. No. That's not correct.

14 Q. Okay. Fix that.

15 A. First of all, I know of no measurements that  
16 Mr. Hardy or Dr. Hardy took. He looked at USGS gauging  
17 data.

18 Q. Oh, you're right. You're right. It's not  
19 measured. That's not the right word. Calculations of  
20 subtracting the 70 CFS flow based on USGS data and,  
21 then, estimating the effect on width and depth,  
22 velocity. You're aware he did those calculations?

23 A. Yes. I am aware of what he did with the U.S.  
24 Geological Survey data.

25 Q. Okay.

1           A. I disagree, emphatically, with the way he came  
2 up with the 1.4 or 1.5 inches. He put single  
3 statistical curve matches to data collected over a, I  
4 think, more than a 20-year period. Multiple  
5 calibrations of flow versus head data were lumped  
6 together that he assigned or asked the computer to give  
7 him a single best fit and developed his 1.5 inches from  
8 a faulty analysis methodology. So, I don't agree  
9 either with the approach he took or with the specific  
10 number that he came up with nor-

11           Q. You haven't done an assessment yourself? You  
12 haven't done the measurements?

13           A. I've looked at those measurements in detail.

14           Q. No. I'm talking about your own study, your  
15 own analysis.

16           A. I have not attempted to analyze the impact of  
17 a 70 CFS change at that gauging station because it  
18 would be irrelevant to anything that goes on were it  
19 1.4 inches or 1.5 inches at the gauging station. That  
20 doesn't indicate it would, necessarily, be 1.5  
21 downstream or an order of magnitude different than  
22 that. It just has no relevance aside from the fact  
23 that I disagree, emphatically, with the approach he  
24 took to come up with the number.

25           Q. No relevance?

1           A. The 1.4 has no relevance downstream. The 1.4  
2 is a derivation of a change that's observed under river  
3 conditions, at a different location, but bears no  
4 resemblance to the river patterns and behavior at  
5 another location. His 1.4 inches—well, a comparable  
6 change of flow in an entirely different regime,  
7 particularly a regime, as described by Dr. Tyus, that  
8 has, under one flow condition, broad areas that can  
9 disappear and the example Dr. Tyus offered, fifty  
10 percent reduction in the width of a backwater, even if  
11 1.4 inches is used, but the point is that, if you have  
12 a channel that has significant broad areas of low  
13 thickness, low water thickness, and a main channel  
14 that's swinging around the edge of the bar, the same  
15 volume loss that Hardy was looking at at Green River,  
16 in a U-shaped channel, roughly a U-shaped channel is  
17 going to have in the case of an asymmetric channel with  
18 a leg that has thin water, all of that water loss has  
19 to come from the small channel and it will drain out.  
20 It will be a much higher change in the asymmetric  
21 channel, the same volume of water loss. It isn't the  
22 1.4 inches that propagates downstream. It's the water  
23 loss.

24           Q. What is the impact to width of a river—say—  
25 let's just pick a number, five thousand CFS. What is



1 the impact to the river of a 70 CFS withdrawal?

2 A. Well, the impact to the flow of the river is  
3 70 divided by 5,000 for volume flow. Beyond that,  
4 without knowing the shape, pattern, the channel,  
5 widths, thicknesses, depths of water across it, excuse  
6 me, the gradient on the river at that point, you cannot  
7 answer that question.

8 Q. I may have asked you this. You weren't here  
9 when Dr. Hardy testified, or were you?

10 A. No. I was not.

11 Q. If you disagree so much with Dr. Hardy's  
12 approach, why don't we have something as an alternative  
13 from you? We don't have that analysis that you're  
14 describing.

15 A. I just described to you what you would have to  
16 do to determine that.

17 Q. That's what I'm asking. Why isn't it done?

18 MS. SWENSEN: Objection. Rhetorical.

19 MR. WRIGHT: It's not.

20 THE COURT: Well, I guess he did not do it and  
21 that's what we have.

22 MR. WRIGHT: Can't I ask him why?

23 MS. SWENSEN: He has testified as to the scope of  
24 his assignment.

25 THE COURT: I would assume it was the scope. I

1 don't know that he was actually asked to do that and I  
2 don't know that it's—he doesn't have that information.

3 So—

4 MR. WRIGHT: Fair enough. Just a moment, Your  
5 Honor.

6 THE COURT: Take your time.

7 MR. WRIGHT: Nothing further, Your Honor.

8 THE COURT: Ms. Valdes, questions?

9 MS. VALDES: I have no questions. Thank you.

10 THE COURT: Re-direct, Mr. Flitton?

11 MR. FLITTON: Just a few questions, Your Honor.

12 THE COURT: Sure.

13 RE-DIRECT EXAMINATION

14 BY MR. FLITTON:

15 Q. In your cross-examination, the question about  
16 the allocation under the Colorado River Compact  
17 regarding the—or, the Upper Basin Compact regarding the  
18 Yampa River was asked. Do you recall that?

19 A. Yes.

20 Q. Okay. Does the fact that there's a guaranteed  
21 flow that would result in 500,000 acre feet annually,  
22 does that change your opinion with respect to the flows  
23 at the Green River Gauge?

24 A. No, not at all.

25 Q. Okay and have you looked at the flows further

1 up the Green River? Have you looked at any of the  
2 gauging stations further up the Green River towards the  
3 Yampa River?

4 A. Yes, actually. I've spent some time looking  
5 at the Green River near Jensen Gauge. It has a good,  
6 long history like the Green River at Green River does  
7 and, then, I've looked at the Green River at Green Gate  
8 which is the one that's been in place since Flaming  
9 Gorge was put in.

10 Q. And are the flows at those gauges generally  
11 higher than the flows at the Green River Gauge?

12 A. It depends on time of year and—I mean,  
13 normally, in a river, you would expect the reverse to  
14 happen as you move down river and pick up more  
15 tributaries, you would expect to see the river gain  
16 water. This summer, the least water was right at  
17 Flaming Gorge where only the water coming out of  
18 Flaming Gorge was. Green River at Jensen had  
19 substantially more flow. It was, probably, not 1,500,  
20 but it would have been more than 1,300 at the Green  
21 River at Green River, the flows, except for one or two  
22 isolated events in Utah tributaries, the Green River  
23 was below the 1,300.

24 So, water had been taken out of the Green River  
25 faster than it was being added by tributaries this

1 summer, this year.

2 Q. So, what you're saying is, by looking at these  
3 various gauging stations—

4 A. Yes.

5 Q. -you see that—and, then, these are below the  
6 Yampa River confluence with the Green, correct?

7 A. The Flaming Gorge is above the Yampa.

8 Q. Right.

9 A. The other two are below the Yampa.

10 Q. Okay.

11 A. Yes.

12 Q. Okay. So, what I thought I heard you say is  
13 that the water is being taken out of the river in  
14 greater quantities than it's even being put in from  
15 those sources?

16 A. It was this summer, during the low season  
17 flow, yes.

18 MR. FLITTON: That's all I have. Thank you, Your  
19 Honor.

20 THE COURT: Questions on those items, Mr. Wright?

21 MR. WRIGHT: Nothing, Your Honor.

22 THE COURT: Ms. Valdes?

23 MS. VALDES: May I have a moment, please?

24 THE COURT: Sure. Take your time.

25 MS. VALDES: I have maybe one or two quick—

1 THE COURT: [inaudible]

2 CROSS-EXAMINATION

3 BY MS. VALDES:

4 Q. Mr. Norris, are you familiar with—first of  
5 all, I should introduce myself. My name is Julie  
6 Valdes. I represent the Utah State Engineer in this  
7 matter and I guess I would just like to ask your  
8 familiarity with Utah's involvement, as a state, with  
9 the recovery implementation plan and the recovery  
10 action plan for the fish. It's our involvement with  
11 federal government. There was a 2010 work group.

12 A. I am aware that Utah is party to those  
13 efforts. I don't know what your involvement has been,  
14 where you've fallen on which sides of various issues,  
15 but I know you are a party to the effort.

16 Q. So, you wouldn't be familiar, then, that Utah  
17 is a committed partner to that process?

18 A. I don't know what that would mean. I would  
19 have to—I mean, I know you're a party to it. I know  
20 you're involved in it. I don't know what that means  
21 beyond that.

22 Q. Okay, thank you.

23 MS. VALDES: That's all.

24 THE COURT: Anything else from anybody?

25 MR. WRIGHT: No, Your Honor.

1 MR. FLITTON: The Plaintiffs rest, Your Honor.

2 THE COURT: Thank you, Mr. Norris. I appreciate  
3 your testimony today.

4 MR. NORRIS: Thank you.

5 THE COURT: So, you rest now?

6 MR. FLITTON: Yes, we do.

7 THE COURT: Rebuttal?

8 MR. WRIGHT: Your Honor, if-

9 THE COURT: Do you want to take a break?

10 MR. WRIGHT: Yeah. I need to talk it over with  
11 the team. Could we have until-

12 THE COURT: Why don't we come back at 3:00?

13 MR. WRIGHT: Yes. That's what I was going to say.

14 THE COURT: Does that give you enough time,  
15 everybody? Okay. We'll be in recess until 3:00, then.  
16 Thank you.

17 [Recess.]

18 THE COURT: Please be seated, ladies and  
19 gentlemen. We'll be back on the record in Emery County  
20 Case Number 1207009. You would think I would have that  
21 memorized. Heal Utah, et al. v. Kane County Water  
22 Conservancy District, et al. All counsel for the  
23 parties is present. I have one housekeeping matter I  
24 want to ask. Mr. Flitton or Ms. Swensen, do you wish  
25 to re-open and offer your exhibits? From 74 on was not

1 offered and I just think it was an oversight.

2 MS. SWENSEN: I know. I think we need to move  
3 from 74 through, I believe, 90, to move for admission  
4 of those. I have that as a housekeeping. I apologize.  
5 We should have done that before we rested.

6 THE COURT: I understand how that goes. Believe  
7 me. Mr. Wright, any objection to the admission of  
8 those exhibits?

9 MR. WRIGHT: No objection.

10 THE COURT: Ms. Valdes?

11 MS. VALDES: No, Your Honor.

12 THE COURT: Exhibits Number 74 through 90 will be  
13 admitted into evidence.

14 MS. SWENSEN: Thank you.

15 THE COURT: Thank you. Mr. Wright?

16 MR. WRIGHT: Your Honor, we have a little bit of  
17 rebuttal.

18 THE COURT: Okay.

19 MR. WRIGHT: The first witness is Mr. Robert  
20 Graber.

21 THE COURT: Mr. Graber, if you would come back up,  
22 please, Sir. You've already been sworn in, Sir. So--

23 ROBERT GRABER re-called as a witness by the  
24 Defendants, having been previously sworn, was examined  
25 and testified on his oath as follows.

1 DIRECT EXAMINATION

2 BY MR. WRIGHT:

3 Q. Mr. Graber, would you—let's start with the  
4 notion of a statistical outlier. When you're doing  
5 statistical analysis, what is an outlier?

6 A. An outlier would be data that is significantly  
7 different from the remaining data, the database you're  
8 using.

9 Q. And, when you're doing an analysis, how do you  
10 deal with outlier data?

11 A. There's several ways, but the ones that I,  
12 typically, do are to exclude the outlier data, delete  
13 it in, first, and see the results and, then, take the  
14 outlier data into account and check the results again  
15 and it significantly changes your conclusions and you  
16 have to make a decision as to whether or not you want  
17 to keep that data.

18 Q. And how do you go about making that decision?

19 A. If the data is significant, in other words, if  
20 you've got—I hope I understand your question, but if  
21 the data is significantly--the results are  
22 significantly different with and without that data,  
23 then, you either—if you keep the data in, you're,  
24 basically, undermining all the rest of the data.

25 Q. I see. All right. Now, you recall Dr.



1 Cooper's testimony concerning—I don't remember what  
2 exhibit this was.

3 MR. WRIGHT: Do you remember the number?

4 MR. FLITTON: I was just trying to find it for  
5 you. Eighty-two.

6 MR. WRIGHT: Eighty-two.

7 Q. Mr. Graber, you recall I asked Dr. Cooper a  
8 few questions about this graph?

9 A. Yes.

10 Q. I asked him about the CPC data and, sort of,  
11 how that was assembled. Do you recall that?

12 A. Yes.

13 Q. Now, have you attempted to do anything to  
14 duplicate that graph, that data collection?

15 A. Yes.

16 Q. Let me hand you—

17 MR. WRIGHT: That's for you. That's for you.  
18 Your Honor, a courtesy.

19 THE COURT: Thank you very much.

20 Q. Mr. Graber, I've handed you what's been marked  
21 as Exhibit 92.

22 A. Yes and I know I'm not supposed to do this.

23 Q. I'm sorry, 91.

24 A. I have to get my glasses. Yes.

25 Q. Would you identify for the Court what Exhibit

1 91 is, please?

2 A. Yes. Exhibit 91 is a virtual identical  
3 screenshot of Mr. Cooper's data.

4 Q. Let's break it up. There are two graphs on  
5 the page.

6 A. Yes, I'm sorry. There's two graphs.

7 Q. What is the top graph?

8 A. The upper graph is the exact duplication of  
9 Exhibit 2.3 from Mr. Cooper's report.

10 Q. How did you duplicate that?

11 A. Well, Mr. Cooper identifies, on that same  
12 Exhibit 2.3, all of his sources and we went to all of  
13 these sources and-

14 Q. I'm sorry. You misunderstood. I didn't make  
15 the question clear. How is it that you duplicated Dr.  
16 Cooper's graph on the top?

17 A. Yeah. We-

18 Q. I'm sorry. I know you-let me start again.  
19 You have Dr. Cooper's graph as part of Exhibit 91.

20 A. Yes.

21 Q. How did you put that on the page? Where did  
22 you get it?

23 A. We took a screenshot off the actual report in  
24 the computer.

25 Q. Okay, thank you. Then, you attempted to

1 duplicate the graph, yes?

2 A. Yes.

3 Q. Tell me how you did that.

4 A. We used all of the reference sources on figure  
5 2.3 of which Dr. Cooper indicates the sources with his  
6 data.

7 Q. All right.

8 A. And, so, we took all this data and formed a  
9 database exactly the same way that he would form the  
10 database to get his results.

11 Q. And, so, the bottom graph on Exhibit 91?

12 A. That is our database compared to the top,  
13 which is directly from Exhibit 2.3, Mr. Cooper's  
14 report. The reason that we compare the two is to  
15 illustrate to the Court that our database very closely,  
16 almost exactly, matches his database to get some  
17 certainty that we're starting them from the same point.

18 Q. Okay, good and, in connection with the concept  
19 of outlier data, what, if any, of the data did you look  
20 at to determine this outlier status?

21 A. The CEC data.

22 Q. And that's the California Energy Commission?

23 A. That is correct. That is the California  
24 Energy Commission.

25 Q. And, then, did you perform the analysis by

1 duplicating or attempting to, at least, duplicate Dr.  
2 Cooper's analysis or results from using that CEC data?

3 A. Yes, we did.

4 MS. SWENSEN: I'm going to lodge an objection at  
5 this time because this is an expert report, expert work  
6 that has never, previously, been provided to us.

7 MR. WRIGHT: It's rebuttal.

8 THE COURT: Strictly rebuttal.

9 MS. SWENSEN: It is rebuttal, but it's, clearly,  
10 work that was done in anticipation of trial, after  
11 receiving Mr. Cooper's report which was in June.

12 MR. WRIGHT: No. No.

13 A. This work was done last night.

14 THE COURT: I think you should let them lay a  
15 foundation, as far as that goes, first.

16 MR. WRIGHT: Yeah.

17 Q. I should have asked when did you do this work?

18 A. We did this late last night.

19 MS. SWENSEN: Okay.

20 A. I emphasize the word late.

21 Q. Okay.

22 THE COURT: Trouble sleeping?

23 A. My partner is a late—he stays up all night,  
24 most of the time, and I found him irritable last night.  
25 I knew I was up late then.

1 Q. Mr. Graber, tell me what Exhibit Number 2 is,  
2 please.

3 A. Which number, 92?

4 Q. Yes. It's the last one I just handed you.

5 A. Yes. Okay. There is—okay. We found, in  
6 Exhibit 92, we show, for each of the dozen  
7 technologies, the dozen resources that Mr. Cooper  
8 refers to, we show, directly as he shows, two chimneys  
9 for each of the technologies. The dark one, the dark  
10 chimney in every technology is just simply the mean  
11 LCOE of all of the data.

12 Q. LCO meaning?

13 A. The levelized cost of electricity.

14 Q. Okay.

15 A. It's just the mean up there, the average.

16 Q. Okay.

17 A. The checkerboard chimney is the LCOE risk  
18 based, risk adjusted.

19 Q. Okay.

20 A. So, Mr. Cooper has taken the LCOE's, the cost  
21 of electricity, and he has taken into account the risk  
22 or the standard deviation of this data and, so, a risky  
23 technology would have a great difference between the  
24 LCOE data and the risk adjusted, which on the graph is  
25 labeled as expected. He labels that expected data, but

1 any technology that has a large difference between  
2 those two is considered a risky technology because  
3 there is a lot of variance in the data.

4 Q. Uh-huh [affirmative]. Okay.

5 A. And meaning that it's not clear, yet, as to  
6 what the LCOE is.

7 Q. Now, in terms—you'll recall, from Exhibit 82,  
8 Dr. Cooper's original graph. He speaks in terms of  
9 LCOE, levelized cost, right?

10 A. Yes.

11 Q. In 2011 dollars?

12 A. Yes.

13 Q. Per megawatt hour?

14 A. Yes.

15 Q. Is that what you understood that to represent?

16 A. Yes. That's very standard.

17 Q. And did you look at that issue about whether  
18 the cost was considered in 2011 dollars across the  
19 board?

20 A. Yes, we did.

21 Q. What did you conclude on that?

22 A. The California Energy Commission data is 2018  
23 nominal dollars.

24 Q. What does that mean?

25 A. That means those are inflated dollars, not

1 real dollars. They're not in 2011 dollars. They're in  
2 2018 inflated dollars. It would take that 2011 data  
3 and inflate it up to 2018 dollars.

4 Q. And what effect did that have on the CEC data?

5 A. It makes it somewhat higher, but more  
6 important than that is that all these figures are not  
7 normalized to one another.

8 Q. What does that mean to normalize?

9 A. You're comparing apples and oranges.

10 Q. Okay.

11 A. Okay. Another thing I want to point out is  
12 the CEC data does not apply to every data point up  
13 there. That's another problem.

14 Q. What does that mean?

15 A. There's two of those—I think it may be at  
16 least two—does not have the CEC data.

17 Q. Which are the two?

18 A. I think both of the carbon capture and storage  
19 technology, CC gas and coal with CCS are not there. I  
20 believe efficiency has only one point from the  
21 California Energy Commission.

22 Q. Okay. Then, what was the next part of your  
23 analysis concerning Exhibit 82?

24 A. Well, we looked and made sure, again, in the  
25 normalization process, that this was all apples-to-

1 oranges—carrying on our apples-to-oranges comparison.  
2 We noticed that, in some of the data, Mr. Cooper had  
3 taken into account production tax credits, investment  
4 tax credits and subsidies from the federal governments,  
5 but he did not—for instance, the EIA and Lizard data  
6 does not include any subsidies, although the EIA has a  
7 transmission investment and a seasonal storage  
8 component in it. So, that data includes tax credits  
9 for both renewable and nuclear. The BEV data includes  
10 production tax credits and investment tax credits,  
11 where applicable.

12 These are—the BEV are the only ones that did that  
13 so, again, you're not looking at a normalized or  
14 apples-to-oranges comparison—

15 Q. Apples-to-apples, you mean?

16 A. Apples-to-apples, yes.

17 Q. Okay. Let's see.

18 MR. WRIGHT: I think I, kind of, screwed-up my  
19 numbering, but, Your Honor—well, I think I've got  
20 these—I was in a bit of a hurry.

21 A. Thank you.

22 Q. Mr. Graber, I've marked Exhibit 93. Would you  
23 please identify that?

24 A. Yes. This is our database, which we've  
25 already shown we can reproduce his database. This is



1 the data, where it exists up there, excluding the  
2 California Energy Commission Data.

3 Q. And why, again, was that done?

4 A. We observed, up there, that the California  
5 Energy Commission was an outlier, okay? In fact, we  
6 know about nuclear and the California Energy Commission  
7 data, for instance, has 900—that's 93.2 cents of cost.  
8 In nuclear, that would be 93.2 cents per kilowatt hour  
9 on the high case of the California Energy Commission.  
10 That figure is unknown. Nobody I have ever seen in my  
11 life has ever seen such a figure.

12 Q. What does Exhibit 93 show us?

13 A. Exhibit 93 shows, when we take it out, that  
14 nuclear is, now, not only not the highest risk  
15 technology on the paper but, now, it is fifth or sixth  
16 in line of being the low-cost, least risk option. Now,  
17 the reason that's important, why we're going through  
18 this, is because all of this data leads to a  
19 conclusion, by Mr. Cooper, on page 49 of his report,  
20 which is in the exhibit, I'm fairly certain, in which  
21 he states, in the penultimate paragraph, the last  
22 sentence nuclear remains an extremely poor choice today  
23 that is likely to become even less competitive as time  
24 passes. These data informed that decision.

25 Q. When you heard him testify, here, about into

1 the future, nuclear just doesn't have a chance to  
2 compete.

3 A. That is correct.

4 MR. WRIGHT: Nothing further, Your Honor.

5 THE COURT: Let's see, cross-examination?

6 MS. SWENSEN: [inaudible]

7 CROSS-EXAMINATION

8 BY MS. SWENSEN:

9 Q. Mr. Graber? I got your name right this time?

10 A. You did. Thank you.

11 Q. All right. First, let's talk about outliers,  
12 just briefly, in the more general sense. I noted that  
13 you explained them for the understanding of the non-  
14 economists here, definitely including myself.  
15 Outliers—correct me if I'm wrong, but outliers are  
16 relevant or important only if you expect the data to be  
17 statistically distributed, correct?

18 A. Statistically distributed?

19 Q. If you're looking at various data points, and  
20 you're expecting them to, essentially, fall within a  
21 certain bounds of probability or you're expecting them  
22 to cluster, to put it very, very simplistically, and  
23 you see an outlier, it's only troubling or significant  
24 that it's an outlier if there's some reason to expect  
25 that the numbers should be closer together, correct?

1           A. No. That's not true. The outlier will cause  
2 you to make a different decision. The outlier will  
3 cause the data to produce a different decision than you  
4 would make if it wasn't there.

5           Q. Once you've determined that it is, in fact, an  
6 outlier, correct?

7           A. Uh-huh [affirmative].

8           Q. But, in order to determine that it's an  
9 outlier, don't you, first, have to know if it's  
10 reasonable to expect all of the data points to be  
11 within a certain range or not? You're making an  
12 assumption that the outlier is simply anything that  
13 falls outside of a certain range, correct?

14          A. No.

15          Q. How are you defining outlier?

16          A. If the decision that results from the data,  
17 with and without the outlier in, is significantly  
18 different, then, we pay attention to that.

19          Q. You pay attention to it. Well, certainly, but  
20 you would not be taking the position that, any time  
21 there's a fact that included in a calculation that is  
22 significant, in that it affects the outcome, then, it  
23 counts as an outlier, right? I know that's not what  
24 you're saying.

25          A. It undermines—it places less importance on all

1 the other data, like up here. All this other data, up  
2 here, that's been collected, if there's an outlier in  
3 there—in the case of the California Energy Commission,  
4 70 percent of the standard deviation can be explained  
5 simply by the one outlier, which is the risk base  
6 calculation. It accounts for seventy percent, by  
7 itself, of all of the standard deviation, including all  
8 of the other data.

9 Q. When you reproduced Mr. Cooper's analysis, you  
10 utilized the sources cited on this exhibit, Exhibit 82,  
11 correct?

12 A. Uh-huh [affirmative].

13 Q. Did you look at any of his levelized cost  
14 estimates from other sources?

15 A. From other sources? I'm sorry.

16 Q. Any source, not to be confused with source  
17 like resource or wind, gas, electric, but source as in  
18 the CEC, Lizard, the various things that are cited  
19 there?

20 A. Yes.

21 Q. Let me back-up.

22 MS. SWENSEN: May I approach, Your Honor?

23 THE COURT: Sure. Absolutely.

24 MS. SWENSEN: Because I know sources gets used in  
25 a couple different ways in this litigation. Sources

1 meaning these inputs, these sources for the data.

2 A. Right.

3 Q. That's what you double-checked, correct?

4 A. Yes, in great detail.

5 Q. Yes and, then, you went on to do your  
6 adjustments based on the data from these sources that  
7 you checked were the same, essentially the same, when  
8 you reproduced it, correct?

9 A. Our intent was to make sure that our database  
10 conformed as close as possible to his initial data.

11 Q. And so we're clear, you did find that the data  
12 that he had extracted from those sources was consistent  
13 with what you extracted from those same sources?

14 A. Not entirely.

15 Q. Not entirely, but—

16 A. No. In some cases, we had to—on one or two or  
17 three data points, up there, that we could not find,  
18 based on his references, we couldn't find the data.  
19 So, we eyeballed it.

20 Q. Okay. So, there were some that you couldn't  
21 find, but were there any that you found that he had  
22 incorrectly extracted the data?

23 A. No.

24 Q. And, so, bringing me back to my question. So,  
25 that was the work that you did dealing with the sources

1 identified in what's been marked as Exhibit 72—or, 82.

2 A. Eighty-two, yes.

3 Q. I even wrote it. Okay, but my question, then,  
4 is, in addition to those sources, did you attempt to  
5 reproduce any of Mr. Cooper's other calculations as to  
6 levelized cost estimates?

7 A. You mean outside of the CEC?

8 Q. Exactly.

9 A. Yes.

10 Q. No. I don't mean outside of just the CEC. I  
11 mean outside of any of those sources identified in  
12 Exhibit 82.

13 A. No. We wanted to reproduce Mr. Cooper's data.

14 Q. I understand. In that exhibit—

15 A. We weren't trying to break ground here.

16 Q. No. I understand that. What I'm asking is,  
17 for example—

18 MR. WRIGHT: I think he has answered it. He said  
19 no.

20 MS. SWENSEN: I'm moving on.

21 MR. WRIGHT: Okay. Sorry.

22 Q. Did I cut you off?

23 A. No.

24 Q. Okay. For example, let's refer to Exhibit 78.  
25 I have a copy here if it's not in the exhibits. It

1 should be.

2 A. Is that the—that's the dispatch curve, right?

3 Q. It's okay if we just use that one for ease of  
4 reference?

5 A. Uh-huh [affirmative].

6 Q. Did you check Mr. Cooper's data in that  
7 exhibit in any sense?

8 A. In this exhibit you just handed me? No.

9 Q. Yes.

10 A. No.

11 Q. Do you have any reason to—you indicate that  
12 the importance of the work that you did in excluding  
13 the CEC data as an outlier is that that exhibit is the  
14 basis for his conclusion that nuclear is not a good  
15 option going forward. Is that—

16 A. No. It forms that statement in his report.  
17 He goes on to do more graphs but, in the end—and all of  
18 them are based on the graph on the data beforehand.  
19 So, we're beforehand, but he, ultimately, gets to the  
20 point where he makes the statement in the book and I  
21 think that data supports his views this morning.

22 Q. I'm not saying the data is inconsistent with  
23 his views. What I'm saying is, is it your position  
24 that, if that data is, let's say, flawed through  
25 inclusion of an outlier, because I understand that to

1 be, essentially, what you've presented, correct?

2 A. Correct.

3 Q. Is it your position that, if that data in that  
4 chart is flawed, that his entire conclusion is wrong?

5 A. Yes.

6 Q. So, what about the additional data that he  
7 relies on?

8 A. Because of the fact—when you say additional  
9 data, are you referring to data outside of the CEC  
10 there?

11 Q. That's exactly—not just the CEC, every data  
12 source exhibited in Exhibit 82. For example, the one  
13 that I've handed you that relies on utility data.

14 A. Uh-huh [affirmative].

15 Q. Doesn't that data support his conclusion as  
16 well?

17 A. I can't—I'll be honest with you. I can't read  
18 the numbers on the—

19 Q. Were you here for Mr. Cooper's testimony this  
20 morning?

21 A. Yes, but see? These data, here, on new  
22 nuclear appear to fit within the range of that data.

23 Q. Is it your understanding that there's no  
24 additional data in that exhibit?

25 A. Oh, no. There's much more data.



1 Q. Right and, so-

2 A. This is only Dr. Cooper that shows up.

3 Q. It's your position that this chart, the one  
4 that was not even presented on direct, is the entirety  
5 of data that Mr. Cooper has relied upon?

6 A. The entirety of data?

7 Q. That's correct. Is it your position that this  
8 is all the data that he has relied upon in reaching his  
9 conclusion?

10 A. On page-no. There is some other data, but  
11 this is as far as we went with it.

12 Q. Correct.

13 A. Okay,

14 Q. I'm not disputing that. That's-and, in fact,  
15 doesn't Mr. Cooper describe, and as you've cited from  
16 his report, earlier, you've read it before, I assume?

17 A. Uh-huh [affirmative].

18 Q. Yes?

19 A. Mr. Cooper's report? Yes, I did read it.

20 Q. You read his report, yes? Doesn't he, in  
21 fact, describe the data in what is Exhibit 82 as non-  
22 utility estimates of the cost of electricity resources?

23 A. Yes.

24 Q. And it's your understanding that he also  
25 presents data from the utility estimates of the cost of

1 electricity resources, correct?

2 A. He may, but it has no bearing on this.

3 Q. That's right. It is completely independent of  
4 this, correct?

5 A. Correct. I just want to point out that he did  
6 say, this morning, that he relies heavily on the Lizard  
7 data, which is part of this data.

8 Q. He did and wasn't he, in fact, citing Lizard  
9 for the projections of wind and solar cost going  
10 forward into the future?

11 A. Say that again.

12 Q. In his testimony, where he indicated that  
13 Lizard was a credible source, wasn't he specifically  
14 talking about the projections of wind and solar costs  
15 going forward into the future?

16 A. He may have, but I'm only looking at this  
17 chart.

18 Q. Uh-huh [affirmative] and did you find--

19 A. Wind is on there.

20 Q. And did you find that Lizard was not credible  
21 when you ran the numbers?

22 A. No.

23 Q. So, when you say he relied on Lizard, do you  
24 have a problem with that?

25 A. Well, you asked me--see? What you said was--

1 what I said was how it undermines. If you look at the  
2 CEC data as an outlier, how it undermines all the other  
3 data because it tends to take over and [inaudible] and  
4 he—in fact, and it does that to the Lizard data as  
5 well.

6 Q. It does, okay. So, let's—and I meant that as  
7 a question, not as a statement. With respect to  
8 Exhibit—let's look at Exhibits 79 and 80. I'm going to  
9 start referring to them. We may start looking at them  
10 actually.

11 A. Okay.

12 Q. You see the—I apologize. I don't have the  
13 title in front of me anymore, but the two exhibits,  
14 there, that are referring to the project cost—the  
15 historical and project cost of wind and solar. Is that  
16 accurate?

17 A. Correct. Uh-huh [affirmative].

18 Q. Do you see the source indicated on the bottom  
19 of both of those?

20 A. Yes.

21 Q. Does the source on either of them include CEC?

22 A. No.

23 Q. So, when you say it undermines his additional  
24 data, including Lizard, you aren't referring to those,  
25 are you?

1 A. This is capital cost data.

2 Q. This is completely separate, correct?

3 A. Yeah.

4 Q. Okay.

5 A. In other words, that's dollars per kilowatt.  
6 This is dollars per megawatt hour.

7 Q. Correct.

8 A. One is electricity. The other is—

9 Q. I understand that they're in different units  
10 and, in fact, that they have different purposes as they  
11 were presented.

12 A. Correct.

13 Q. My point is, simply, that, when you say Mr.  
14 Cooper incorrectly included the CEC, and that indicts  
15 all of his conclusions, you mean with respect, solely,  
16 to the levelized cost estimates presented in Exhibit  
17 82, correct?

18 A. That is correct and that was what he was  
19 talking about this morning.

20 Q. Okay.

21 MS. SWENSEN: I have nothing further. Thank you.

22 A. Thank you.

23 THE COURT: Questions, Ms. Valdes?

24 MS. VALDES: No. Thank you, Your Honor.

25 MR. GRABER: I think I may luck out driving.

1 MR. WRIGHT: Nothing further, Your Honor.

2 THE COURT: Thank you. You may step down.

3 MR. GRABER: Thank you, Your Honor.

4 THE COURT: Thank you, Mr. Graber.

5 MR. WRIGHT: Your Honor, our second and last  
6 rebuttal witness is Dr. Nils Diaz.

7 THE COURT: Dr. Diaz, if you would please come  
8 forward, Sir.

9 NILS DIAZ, PH.D. re-called as a witness by the  
10 Defendants, having been previously sworn, was examined  
11 and testified on his oath as follows.

12 DIRECT EXAMINATION

13 BY MR. WRIGHT:

14 Q. Dr. Diaz?

15 A. Yes, Sir.

16 Q. You were here during—well, the entire trial—

17 A. That's correct.

18 Q. —so far. Let's—I'm going to hit a couple of  
19 points here. You heard Mr. Gunderson talk about the  
20 Carnot Cycle?

21 A. That's correct.

22 Q. Would you—he talked about it. Would you just,  
23 very briefly, tell the Court what the Carnot Cycles  
24 are, to remind us?

25 A. Well, it's, kind of, an idealistic way that is

1 used to determine what could be deficiency, but it has  
2 no practical use in steam plants, the cycle that is  
3 used. The one that actually determines the efficiency  
4 is the Rankin Cycle or steam plants are ruled by the  
5 Rankin Cycle and it's the Rankin Cycle that we tried to  
6 make improvements and changes to. The Carnot Cycle is  
7 just a laboratory or upper level idealistic issuance.  
8 It's a good discussion, but it's, really, not relevant  
9 to practical situations.

10 Q. Mr. Gunderson also talked about cooling towers  
11 and, sort of, how they function in a thermal power  
12 plant of the kind that we're talking about here and any  
13 other kind of thermal plant, correct?

14 A. Correct.

15 Q. How are the cooling towers, say that might be  
16 used at the proposed plant, any different from any  
17 other cooling towers that might exist at any coal  
18 plants around here?

19 A. Well, like I said, they are practically  
20 exactly the same. They use the same principals. They  
21 use the same water control issues. They use the same  
22 type of chemical controls. They use the same types.  
23 It is correct that nuclear power plants use a little  
24 bit more water. I testified to that yesterday. The  
25 difference depends on the age of the plant. It could

1 be ten, fifteen percent but, for example, all the power  
2 plants in Utah use mechanical cooling towers like the  
3 ones we are proposing for BCH. I don't know of any  
4 issues or any problems with any of those power plants  
5 in Utah from the environmental viewpoint, from the  
6 water usage viewpoint, from any of the other  
7 viewpoints. They are the same.

8 We use a little bit more water, yeah. That's  
9 true, but is it any difference or creates any different  
10 risk that compromises the environment or farmers or any  
11 of the other things that were brought up, like  
12 potential risk, the answer is no. They're the same.

13 Q. All right. Mr. Gunderson talked about drift.  
14 Do you remember that?

15 A. Yes.

16 Q. And is that something, an issue that the  
17 Nuclear Regulatory Commission will consider in its  
18 analysis of any application?

19 A. Actually, it will consider it and it will  
20 consider it in partnership with the state. In fact,  
21 our exhibit, I think—

22 Q. Let's turn to it, Exhibit 52.

23 A. Exhibit 52.

24 Q. Look in the binder.

25 A. In the binder?

1 Q. Uh-huh [affirmative] and of that exhibit, turn  
2 to page 4.7-6.

3 A. This is the United States Nuclear Regulatory  
4 Guide 4.7, general size suitability criteria for  
5 nuclear power stations.

6 Q. You'll see on that page, 4.7-6, on the right-  
7 hand side, under the heading water quality-

8 A. Correct.

9 Q. --would you read that first couple of  
10 sentences, please?

11 A. Sure. There are three sentences in here, in  
12 the paragraph, that are applicable. The first one's a  
13 thermal and chemical effluence discharge to nautical  
14 streams, the Green River, are governed by the Federal  
15 Water Pollution Control Act, as amended, and state  
16 water quality standards. The applicants would also  
17 determine whether there are other regulations that are  
18 important at the time sites are under consideration.

19 The rest of it is just, really, additional things,  
20 but in the middle of the page it says that a nuclear  
21 power-an applicant for a construction permit, early  
22 site permit or combined license for a nuclear power  
23 station will provide to the NRC certification from the  
24 State that any discharge will comply with applicable,  
25 effluent limitations and other water pollution control



1 requirements.

2 In the absence of such certification, no  
3 construction permit, early site permit or combined  
4 license can be issued by NRC unless the requirement is  
5 waived by the state or the state fails to act within a  
6 reasonable period.

7 May I read the last—

8 Q. Of course.

9 A. On the next paragraph, the beginning, I think,  
10 is applicable, Your Honor. Evaluations of the  
11 dispersion and dilution capabilities and potential  
12 contamination pathways of the groundwater environment  
13 under operating and accident conditions with respect to  
14 present and future uses are required. Potential  
15 radiological and non-radiological contaminants of  
16 groundwater should be evaluated. I think that's  
17 sufficient.

18 Q. Thank you. Do you recall Mr. Gunderson being  
19 asked the question about whether the State of Utah can  
20 veto a decision by the Nuclear Regulatory Commission?  
21 Do you recall that?

22 A. Yes, I do.

23 Q. Would you explain the State's role in  
24 connection with the environmental analysis, the  
25 environmental impact statement, please?

1           A. Yes. The licensings go through an evolution  
2 that actually should result or not in a license. The  
3 state, in this particular case of an early site permit  
4 of any environmental considerations, will be a  
5 participant in the decision. The NRC will not even  
6 commence the evaluation of the application unless it  
7 has a certification or a certificate from the State  
8 saying yes, there is a water permit. Yes, we are going  
9 to, you know, continue the discussions in a manner that  
10 any structure, any issues that are coming, we will be  
11 in discussions. The EPA and the State will actually  
12 establish roles that they will fulfill and those will  
13 continue until the draft environmental impact  
14 statement.

15           Q. What happens then?

16           A. The draft environmental impact statement is  
17 sent out, but it's specifically sent out to all  
18 applicable federal and state agencies for comment and  
19 discussion at which time, you know, the State will have  
20 an opportunity to review not only what the applicant  
21 has submitted, and all of the designs, but what the NRC  
22 staff has actually improved and actually, you know,  
23 added because, if the applicant or the State have not  
24 had an appropriate aquatic evaluation of the river, the  
25 NRC will do it independently. It will be added to the

1 record and the State will be able to review and, then,  
2 before the final environmental impact statement is  
3 issued, there is a continual discussion that is  
4 incorporated into the record and, eventually, a final  
5 environmental impact statement is, then, issued which  
6 becomes, then, the actual document that will control  
7 the license.

8 Q. What is the only decision by the NRC that the  
9 State cannot veto, in effect, or cannot undo?

10 A. Well, once the license is issued, the NRC  
11 concludes that the applicant has complied with all  
12 applicable federal and state, you know, conditions and  
13 the license is issued at that time, under those  
14 conditions. As long as the applicant continues to  
15 fulfill those conditions, the license is valid. So, if  
16 the State decides, five years later, that, you know,  
17 you need to put a mosquito screen over the entrance,  
18 the federal government will say, yeah. That's okay,  
19 but they may say no.

20 So, the license rules and this was done in order  
21 to, like all license, to protect the people that  
22 actually have made the investment and protect the  
23 license and there are even regulations called back-  
24 feeding that apply at that time.

25 MR. WRIGHT: Nothing further, Your Honor.

1 THE COURT: Cross-examination?

2 MR. FLITTON: Nothing, Your Honor.

3 THE COURT: Nothing? Ms. Valdes?

4 MS. VALDES? Nothing, Your Honor.

5 THE COURT: Thank you, Dr. Diaz. I appreciate it.

6 DR. DIAZ: Thank you.

7 MR. WRIGHT: Your Honor, that concludes our  
8 rebuttal.

9 THE COURT: Thank you, Mr. Wright. Any sur-  
10 rebuttal that the Plaintiffs would like to—any sur-  
11 rebuttal witnesses the plaintiffs would like to call?

12 MS. SWENSEN: No, Your Honor. Thank you.

13 THE COURT: Thank you. What I would like to talk  
14 about, now, with counsel is I'm unaware if the parties  
15 want to make closing arguments or if you would like to  
16 submit written briefs. What would you prefer to do?  
17 I'm happy to do it either way.

18 MR. WRIGHT: Well, from the applicant's side, Your  
19 Honor, I think we're here and we'd like to do closing  
20 arguments, but I think we would prefer to do them first  
21 thing in the morning, give us a little time. There's  
22 been a ton of witnesses and a lot of exhibits. I think  
23 John and I have talked about that and I think we're in  
24 agreement.

25 THE COURT: Is that correct?

1 MR. FLITTON: Yeah. I would prefer to start a  
2 little bit later tomorrow just to have a little bit of  
3 extra time to prepare the closing, but what we talked  
4 about is we'd like to get out of here, hopefully,  
5 around the noon hour sometime.

6 MR. WRIGHT: Yeah and what we've agreed to is I'll  
7 go for an hour, assuming I take an hour, but I,  
8 probably, will. Then, the protestants get an hour and  
9 I get a half hour rebuttal and we're done and Julie  
10 Valdes, of course, has—sorry.

11 MS. VALDES: That's okay. I anticipate taking  
12 about ten to fifteen minutes, maybe a little bit more  
13 or less than that, but I would like to have closing  
14 arguments. How I would fit into this scheme, I'm not  
15 exactly sure.

16 THE COURT: Since, in this particular case, the  
17 applicants have the burden, of course, they go first,  
18 then, the Defendant. Then, the State Engineer—or,  
19 then, the Plaintiffs, excuse me. Then, the State  
20 Engineer.

21 MS. VALDES: That sounds great.

22 THE COURT: All right. In terms of time, would  
23 you like to start at 9:00 or 9:30.

24 MR. FLITTON: 9:30 works.

25 MR. WRIGHT: 9:30 is okay.

1 THE COURT: Is that enough time, do you think, or  
2 would you like to start later? Since this whole day is  
3 open, I've got it all blocked out.

4 MR. FLITTON: 9:30 is okay. That way, we can get  
5 done at a reasonable time.

6 MR. WRIGHT: Yeah.

7 THE COURT: All right. Then, what well do is  
8 we'll adjourn for the day, meet again at 9:30 for  
9 closing arguments. Thanks everybody and I want to  
10 thank everybody in the audience. I know it's been a  
11 long week.

12 MR. WRIGHT: Thank you, Your Honor.

13 MS. VALDES: Thank you, Your Honor.

14 THE COURT: Court will be in recess until 9:30 in  
15 the morning.

16 BAILIFF: Please rise.

17 THE COURT: Let me back-up. One more—before we  
18 get off the record, do you want to offer your exhibits  
19 in rebuttal?

20 MR. WRIGHT: Oh, 91, 92 and 93, I believe.

21 THE COURT: Any objection to the Court receiving  
22 those?

23 MR. FLITTON: No, Your Honor.

24 THE COURT: Thank you. Exhibits 91, 92 and 93 are  
25 admitted into evidence. Thank you.

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BAILIFF: Please rise.

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C E R T I F I C A T E

I, Ruby Rudisill, do hereby certify that the foregoing pages contain a true and accurate transcript of the electronically recorded proceedings and was transcribed by me to the best of my ability.

\_\_\_\_\_  
Ruby Rudisill

I, Kelly Thacker, do certify this transcription was prepared under my supervision and direction.

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Kelly Thacker