

1 MARCH 17, 2004

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

3 CONTINUING...

4 THE BAILIFF: All rise.

5 (Jury returned into open court.)

6 THE COURT: You may be seated.

7 Mr. ~~XXXXXXXX~~, call your next witness.

8 MR. ~~XXXXXXXX~~: Your Honor, the defense calls Dr.  
9 Martin Moore-Ede.

10 THE COURT: Would you raise your right hand?

11 (Witness sworn by the Court.)

12 THE COURT: You may take the stand.

13 THE WITNESS: Thank you, Your Honor.

14 DR. MARTIN MOORE-EDE

15 having been previously sworn by the Court, testified on  
16 his oath as follows:

17 DIRECT EXAMINATION

18 BY MR. ~~XXXXXXXX~~:

19 Q Good morning, Doctor. Could you introduce  
20 yourself to the jury?

21 A Yes. Good morning. My name is Dr. Martin  
22 Moore-Ede.

23 Q And where are you from originally?

24 A Originally from London, England.

25 Q And you have lived in the United States for a

1 while?

2 A Yes. I have. I have actually lived in the  
3 United States almost 30 years at this point.

4 Q Where do you presently live?

5 A I live in Boston, Massachusetts.

6 Q And originally did we have you scheduled to be  
7 here yesterday?

8 A You did indeed, yes.

9 Q And did you have travel and everything set up  
10 for that?

11 A Yes. I was at the airport ready to come.

12 Q And did I through some other people advise you  
13 that we were having trouble getting a jury and to revise  
14 that one day?

15 A Yes, you did. I went back home again.

16 Q In any event, what do you do for a living?

17 A I am the CEO of a consulting firm, a research  
18 and consulting firm that specializes in the problems of  
19 fatigue in industries that run 24-7, whenever people are  
20 working shift work around the clock. We specialize in  
21 helping identify that problem and helping reduce the risk  
22 of cause and effect type accidents in shift work and  
23 around-the-clock type operations like airlines and  
24 railroads and police forces and so forth.

25 Q And what kind of background do you have to hold

1 that position?

2 A Well, my training was originally in medicine,  
3 and I am qualified in medicine in England. I then went  
4 and started as a surgeon in a surgical career and  
5 training and found I was working 36 hour shifts in the  
6 surgery and training on my feet for 36 hours and then off  
7 for 12 and back in for 36. And needless to say, after a  
8 week or a few days of that or a week of that I got  
9 extremely fatigued. I was nodding off in the operating  
10 room and falling asleep at inopportune times. And I  
11 eventually got interested in the issue of fatigue at that  
12 point.

13 And I went to graduate school eventually and  
14 did a Ph.D. at Harvard on the whole issue of circadian  
15 rhythms and sleep and fatigue. In other words, what  
16 makes you sleep at night and what makes you awake  
17 normally during the daytime. And that is my specialty.

18 Q You said that you were suffering from fatigue  
19 from these long shifts at the hospital. Was that in  
20 England?

21 A That was -- actually my training was over here.  
22 It was actually in Canada where I did my surgical  
23 internship. I was a surgical intern, much like you see  
24 on ER, working those extended hours.

25 Q Is that similar to, like, our medical residency

1 program in the United States where the young doctors  
2 become residents in the hospital?

3 A Exactly the same thing.

4 Q Now, you said, I noticed that I was suffering  
5 from fatigue. What were some of the things that you  
6 noticed about yourself that caused you to --

7 MS. SICA: Objection. This is irrelevant.

8 THE COURT: Sustained.

9 Q (By Mr. Milner) You said you went over and did  
10 a Ph.D. at Harvard. What exactly is your educational  
11 background?

12 A My Ph.D. was in Physiology, which is the study  
13 of the human body and circadian factors, which is the  
14 regulation of the body cycles, the day and night cycles.  
15 And I completed my Ph.D. in 1964 at Harvard Medical  
16 School.

17 MR. [REDACTED]: May I approach the witness, Your  
18 Honor?

19 THE COURT: You may.

20 Q Let me show you what is marked as Defense  
21 Exhibit 1. Can you identify this for the jury?

22 A Yes. That is my curriculum vitae and some of  
23 my publications.

24 Q Does this give a very in-depth summary of your  
25 educational and professional background as well as

1 publications and books and articles?

2 A Yes, it does.

3 Q How many books do you have published in this  
4 subject area?

5 A I have ten books published.

6 Q Have you ever written any peer reviewed  
7 articles?

8 A Yes. I have written over 140 peer reviewed  
9 articles.

10 Q And does this literally list the books which  
11 have been published over the last ten years as well as  
12 the articles which have been published over the last ten  
13 years?

14 A Yes. It lists the most recent ones of those  
15 articles and books.

16 Q And have you -- are there some articles -- this  
17 goes up through 139?

18 A That is a little bit out of date. There is a  
19 couple of more since then.

20 MR. ~~REDACTED~~ In any event, we would move to  
21 admit Defendant's Exhibit 1.

22 MS. SICA: No objection.

23 THE COURT: It's admitted.

24 Q (By Mr. Milner) Let me go through this. You  
25 said: I have done a lot of research; I have written a lot

1 of articles. And, obviously you know this is a DWI  
2 trial, correct?

3 A I do, yes.

4 Q I mean, has it been the focus of your career to  
5 study DWI or anything to do with DWI?

6 A Not specifically. The focus has been on  
7 fatigue itself and sleep deprivation and fatigue.

8 Q In that regard -- and you have been doing this  
9 for -- obviously it's been years, and you have written a  
10 lot of articles. Have you done an extensive amount of  
11 research in the way sleep deprivation affects the body?

12 A Yes, I have.

13 Q Who sponsored it? I mean, this kind of  
14 research takes a lot of time. Who sponsors these? I  
15 mean, who are the people that are paying you to go out  
16 and do the research that you do?

17 MS. SICA: Objection. That is irrelevant.

18 THE COURT: Sustained.

19 MR. ████████: May we approach on this?

20 THE COURT: You may.

21 (Off-the-record discussion.)

22 Q (By Mr. ████████) Dr. Moore-Ede, who sponsored  
23 you? Who's hiring you to do this?

24 A Right. The research has been sponsored by  
25 various government agencies, including NASA, the United

1 States Air Force, the Army, the National Institute of  
2 Health and the National Science Foundation, as well as a  
3 number of companies who have got to run 24-7 operations  
4 and are very interested about the issue of fatigue.

5 Q Does the issue of fatigue cause losses to these  
6 government agencies like NASA and the United States Air  
7 Force and all of these big companies that have people  
8 working around the clock?

9 A Yes, it does. It's a big issue for the Air  
10 Force and for NASA and the whole problem of jet lag when  
11 people get extremely fatigued because they are flying  
12 across time zones. We did a big project for the Air  
13 Force that had to do with jet lag. And it's an issue for  
14 companies that run 24-7 or run around the clock because  
15 there are more accidents in the area after midnight.  
16 People are more likely to fall asleep at the wheel or at  
17 the control office. It's a very big concern. In fact,  
18 it's a problem everywhere.

19 We have moved our world from a nine-to-five day  
20 to a 24-7 day, where things just run nonstop around the  
21 clock. And it's a huge issue in the more global economy.

22 Q And have we hired you to do a complete analysis  
23 of the case involving ~~John~~ ~~\_\_\_\_\_~~?

24 A Yes, you have.

25 Q And if we talked about -- you said the safety

1 States Air Force, the Army, the National Institute of  
2 Health and the National Science Foundation, as well as a  
3 number of companies who have got to run 24-7 operations  
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23 of the case involving ~~John~~ ~~\_\_\_\_\_~~?

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25 Q And if we talked about -- you said the safety



1 and people driving. If we talk about how sleep  
2 deprivation and fatigue relates to driving, you said it's  
3 a safety issue. I mean, is it a minor safety issue where  
4 we get a few fender-benders as a result of this, or how  
5 significant is the safety concern related specifically to  
6 sleep deprivation and driving?

7 A It's one of the major causes of accidents,  
8 particularly serious accidents behind the wheel. There  
9 are an estimate of the fatality accidents on the freeways  
10 up to 40 or 50 percent of various accidents are related  
11 to fatigued individuals. In fact, it's been a more  
12 important problem than alcohol and many issues. In fact,  
13 in the trucking industry, as an example, a fatigued  
14 driver is a much more common cause of an accident than a  
15 driver that is intoxicated.

16 And this has been a growing awareness that this  
17 is a huge problem. In fact, something like 40 percent of  
18 Americans admit to being extremely sleepy behind the  
19 wheel and occasionally nodding off behind the wheel.  
20 It's a pretty common problem and a pretty dangerous one.

21 Q Have you prepared a power point presentation to  
22 start off going through step-by-step, A, how this  
23 generally works and how the investigation relates to ~~\_\_\_\_\_~~

24 ~~\_\_\_\_\_~~  
25 A Yes, I have.

1           People normally assume we sleep at night  
2 because it's dark or because that is just a natural way  
3 of doing it. In fact, we sleep at night because our  
4 brains are wired that way. Ever since a million years  
5 ago when we were running around as cavemen -- or our  
6 ancestors were -- we actually slept at night because we  
7 humans have a poor sense of vision at night and poor  
8 sense of smell. We are just not very good survivors in  
9 the world. Those that wandered around got eaten. And it  
10 so happened and evolved that this biological clock in the  
11 brain -- it's labeled there. But it's a little clock  
12 just like the pacemaker in your heart.

13           Only this is the pacemaker that makes you sleep  
14 at night time and awake during the daytime. So, we are  
15 on a regular schedule that is synchronized to the world  
16 we are in. It synchronizes the todays and tonights and  
17 keeps us in step.

18           Q     Okay. What is this chart showing us here?  
19 Explain this to us.

20           A     Yes. This chart shows the pattern over a  
21 typical -- a typical nine-to-five schedule. So, just  
22 take a typical pattern of someone who might be working  
23 from 9:00 to 5:00 during the daytime, which is the blue  
24 bars here. And here is Monday, Tuesday, Wednesday,  
25 Thursday, Friday of the work week. Here is a weekend of

1 the Saturday and Sunday. Just a Saturday and Sunday  
2 weekend here. And then here is the next week.

3 As you see, a typical person might go to bed,  
4 let's say, at 11:00 p.m. and wake at 7:00 and get up,  
5 shower, have breakfast. Commute is the green. Then go  
6 to work and then commute back home and have the evening  
7 off. So, that would be just a totally basic schedule.

8 Then, of course, on the weekend we tend to stay  
9 up a little bit later often on Friday and Saturday nights  
10 and sleep in a little bit later. Most people do, or many  
11 people do on Saturdays and Sunday mornings. And then we  
12 go back to the workday schedule.

13 So, it's just a way of introducing how when we  
14 analyze sleep wave patterns, how we clock them, and how I  
15 have. Basically, what we are looking at is the time of  
16 day here from midnight to midnight, and here is each  
17 successive day shown under the others. So, you can see  
18 the sort of progression of time.

19 Normally we live a very regular life. Our  
20 bodies are designed to sleep regularly at the same time  
21 and designed to work at the same time every day. That  
22 is, you know, a pattern that used to be much more common  
23 than it is today.

24 Q Is the pattern of sleep -- is that important as  
25 it relates to fatigue?

1           A     Yes, it is. What actually is very important to  
2 healthy sleep is sleeping at the same time, in the same  
3 bed, and in the same schedule. In fact, that enables the  
4 sleep patterns to get stabilized, and enables you to get  
5 the most restful sleep.

6           Where you get in trouble is where you're  
7 staying up at night or trying to sleep during the daytime  
8 or shifting around a lot. So, that is when you get sort  
9 of chronic fatigue and exhaustion. Too often people --  
10 because of family responsibilities, because of job  
11 responsibilities, are forced out of this normal behavior,  
12 and that is why fatigue is a problem in the world today.

13          Q     Okay. What does this show us here?

14          A     Basically, the other side of sleep is how alert  
15 you are. And what we measure is we measure ranging from  
16 a range of alertness, which means your brain is fully  
17 functioning. You're not falling asleep. You're paying  
18 attention. As you are right now. Fully alert.

19          Then it's way down to being extremely sleepy,  
20 where you can't keep your eyes open and you fall asleep  
21 in your chair. Normally over the course of day and night  
22 we vary. So, we might be there. There is certain times  
23 of the day that we are much more alert, and other times  
24 of the day, like after lunch -- I am glad I am not doing  
25 this immediately after lunch. It's a bit more

1 challenging to keep people's eyes open.

2           The problem is when you drop below a certain  
3 level you get into what is called fatigue impairment.  
4 That is where you're so drowsy that, in fact, you are  
5 more likely to make mistakes, have accidents, forget your  
6 own name. When I was a doctor I wrote prescriptions I  
7 couldn't make sense of the next day when I was down in  
8 this state.

9           So, this is the danger zone, and that is why we  
10 mark it as red.

11           Q     Is that a measurable amount? When we say  
12 fatigue impairment below a certain range, is there a  
13 quantitative measurement where you can say, Below a  
14 certain level this person is going to suffer from  
15 impairment?

16           A     There absolutely is. And the simplest test we  
17 can do is take anybody and we have a bedroom, just next  
18 door. And we just take you to the bedroom, lay you down,  
19 switch out the lights, and see how long it is before you  
20 actually sleep.

21           So, if you're wide awake, like you might be  
22 now, you just lay there with your eyes open. You just  
23 can't fall asleep. But, on the other hand, if you're  
24 drowsy, your head hits the pillow and you immediately  
25 fall asleep.

1           On the next slide we actually show how they  
2 measure it. It's called the sleep test. That varies  
3 between falling asleep within a minute, less than a  
4 minute of falling asleep, not falling asleep at all in 20  
5 minutes. So, we have a variety between very alert and  
6 asleep. We have a scale of zero minutes to 20 minutes.  
7 And it's a way of measuring how sleepy you are.

8           So, in other words, we can take any one of the  
9 jurors right now, and actually test how sleepy you are  
10 and put a number to it.

11           Q     How could you do it in a real human being? In  
12 a human world, how do you test somebody?

13           A     How we actually do it is we glue some wires to  
14 the head of -- or to the scalp. And we can measure brain  
15 waves on a electroencephalogram or EEG. And with that  
16 EEG we can actually -- we can monitor the EEG's. We can  
17 see the moment a person drops from being awake to asleep.  
18 We can actually count the minutes it takes to fall  
19 asleep. So, we can actually measure it by wiring you up  
20 in the lab. It's a bit like, you know, a test where  
21 they put these wires into your head and plug you into a  
22 machine and you can record it.

23           Q     How may times have you done that?

24           A     Thousands of times in the course of 25 years of  
25 research.

1 Q Is this well recognized research?

2 A It is. It is universally recognized. There  
3 are ten thousands or many thousands of researchers in  
4 Universities around the world doing this type of  
5 research. There is an annual meeting of the Sleep  
6 Society, which has ten thousand attendees to it. So,  
7 it's a very well established body of science, a very  
8 important body of science about sleep and the deprivation  
9 and the effects of fatigue.

10 Q Now, what is this second part of the graph  
11 showing us?

12 A Well, the left side and the right side, first  
13 of all, show what the effects of having too little sleep  
14 are on fatigue. So, if we take this measure, we first  
15 look at the left side of this and we look at people who  
16 have eight hours sleep the previous night.

17 In others words, if you have a guy, eight hours  
18 sleep, your age, the alertness is going to be pretty  
19 high. It's going to go up and down, but it's going to be  
20 pretty high.

21 But, if indeed, last night you have seven hours  
22 or six hours or even five -- there is not much change in  
23 one night. But to go below four hours, you're just  
24 basically going to start losing it. So, people who get  
25 four hours or three hours of sleep or less get extremely

1 impaired in just one night.

2 The right hand side of the slide shows that  
3 even if you're up here getting five hours sleep or six  
4 hours sleep, and it's one night you are okay.

5 If you do that night after night, it's a  
6 cumulative effect. We have something that we might call  
7 a sleep banking account, whereby when we occasionally get  
8 into sleep depravity we gradually lose the amount of  
9 sleep in the reserves. And as a result, we are more  
10 vulnerable and get sleepier and sleepier during the week.  
11 So, this might represent a tough week. On Monday you're  
12 okay, but Tuesday you're going downhill. And by Friday  
13 you're really walking around like a zombie.

14 So, that might represent this.

15 Again, this is all scientifically tested by  
16 measuring hundreds of people to find out how many minutes  
17 it takes them to slip into a sleep under very controlled  
18 circumstances.

19 Q Does this show us, like, if I go one night and  
20 I had to work really late, the next day I'm a little  
21 behind. But then I make up for it the next day, and  
22 after that I'm okay.

23 A Eventually, absolutely. You can catch up. A  
24 good nights sleep or simply a couple of good nights sleep  
25 brings you right back. So, like a weekend -- if you get



1 a good, long sleep on the weekend you can be fairly  
2 recovered.

3 Q And the opposite of that is if you have a rough  
4 night and you had to work late and then it happens again,  
5 you start to feel a lot worse than you already do?

6 A That is right. It builds up. So, the level of  
7 drowsiness, the level of sleepiness, builds up.

8 If you go running chronically short of sleep --  
9 and too many of us are running short of sleep. We are  
10 trying to deal with family issues. We are trying to deal  
11 with work issues and so forth. And that builds up and  
12 that is the problem that we are facing. That is why  
13 America is said to have a very significant sleep dep as a  
14 nation.

15 Q If we look at this one, you had already earlier  
16 said that there are patterns. What is this chart showing  
17 us? I guess, it's -- this is preliminary. Can you tell  
18 us what circadian rhythm means?

19 A Yes. Circadian is from -- it's a word that  
20 means the biological changes across the day. Circa means  
21 from the Latin around. Dian is a day. So, it means all  
22 the things, like sleep cycles, body temperature and the  
23 whole -- everything that varies over the course of a day  
24 and night in the system is the circadian rhythms. And we  
25 have circadian rhythms in thousands of things including

1 our alertness.

2 So that this is a pattern of the rhythms. It  
3 shows that. This is again the same scale, the one that  
4 we do in the bedroom. And we measure how long it takes  
5 to fall asleep, ranging from zero to 20 minutes. And  
6 this is a full day loop.

7 And if we take a whole group of people -- in  
8 fact, this is nine different individual studies all  
9 combined so to give us -- people tend to be more alert in  
10 the middle of the morning. There is a post lunch dip in  
11 the siesta hour after lunch. And then people get a surge  
12 in the evening.

13 There is some variance between people. If  
14 you're a morning-type person, you're getting up, and  
15 you're full of vim and vigor. You will have a higher  
16 peak. If you're one of the late-night people, you will  
17 have less of a peak here and more of a peak in the  
18 evening. But, basically, there is human nature of this  
19 pattern of alertness during the day. And a normal,  
20 heathy person will stay above the danger zone line where  
21 you are fatigue impaired.

22 Q Now, what does this one show us?

23 A Well, this shows the results in the same  
24 research studies of those nine research studies, what  
25 happens if you take people through a pattern where, first

1 of all, they had a reduced night of sleep. In other  
2 words, they had less sleep than normal. And the same  
3 two-part pattern is found, but the whole pattern is  
4 brought down by having less sleep.

5 But if you get down into a pattern where  
6 someone has no sleep, in other words, they are up 24  
7 hours straight, this level of alertness drops way down  
8 into that danger zone. So, they then become what we call  
9 fatigue impaired, when they are down in this zone here.

10 Q Okay. There is points on here, even when we  
11 are getting into the fatigue impaired, where it seems to  
12 go up and down. Can you -- is there a reason for that?

13 A Yes. In fact, when a person is fatigue  
14 impaired, one of the distinctive features of it is that  
15 you become alert for a while. You can fight it for a  
16 while. It's like fighting sleep. And then it overcomes  
17 you. And then you fight it again, and then it overcomes  
18 you. So, it's something that you can fight against to a  
19 certain extent. You just can't sustain being fully alert  
20 at that point in time.

21 So, people can get a little bit better or a  
22 little bit worse over the course of time.

23 Q So, this would be like where you are sort of  
24 shaking yourself out of it, if it's a truck driver on the  
25 road, and then they start dozing?

1 A Right.

2 Q And then they sort of snap to?

3 A You know, you drive. You drop off the road.  
4 You hit the rumble strip. It frightens you. You wake  
5 up. And you are going to be awake for the next ten  
6 minutes. And then before you know it, you do it again.  
7 It's that circumstance.

8 Q It creates kind of peaks and valleys in terms  
9 of the level of fatigue?

10 A That is right.

11 Q Now, what does this show us here? Can you  
12 explain this?

13 A Yes. This now summarizes. I have shown a lot  
14 of graphs and charts. But people in the world --  
15 basically what determines whether you're going to become  
16 fatigue impaired or not -- well, one of the things is the  
17 time of day, the time of day in terms of that biological  
18 clock in the brain. So, you have that biological clock  
19 that regulates sleep and wakefulness. If it's 4:00 in  
20 the morning, that is a tough time. So, that is  
21 important. That is going to depend on when you're likely  
22 to be sleepy.

23 The next important thing is how long has he  
24 been awake since the last time he slept? In other words,  
25 if you have been awake for only ten hours, then you're

1 going to be much more awake than if you have been awake  
2 for 20 hours or 24 hours straight or 30 hours straight.  
3 There is a function of how long you have been without  
4 sleep.

5           Then the next thing you want to know is how  
6 much sleep did the person have, what is the length of  
7 time of that last sleep. You know, if the last sleep is  
8 a full eight hours or ten hours. Was it only six hours  
9 or four hours? That will make a difference. The  
10 quantity of sleep is very important, because as you know,  
11 you can be asleep but you don't have a restful night.  
12 You can have a husband who snores and keeps you awake.  
13 You can have a spouse that has a restless night. You  
14 could have a child who's waking up or moving around. Or  
15 you can be in a bed that is uncomfortable.

16           All of those things may influence the quality  
17 of sleep. So, if it's a poor quality of sleep, you would  
18 obviously be much drowsier than if you have good quality  
19 sleep.

20           And then the last thing is cumulative sleep  
21 depravation over the past week. It's not just the one  
22 day. It's the multiple days leading up to that period of  
23 time. It's how much sleep deprivation have you had.

24           So, all of these -- the key point is that all  
25 of those are impacted when you travel across time zones.

1 So, if you fly to Japan, if you fly to Hawaii, if you fly  
2 to Paris -- any one of these types of trips, you are now  
3 actually going to be out of step with your circadian  
4 rhythms. Your body is on Dallas time, but you are trying  
5 to sleep on Paris time, which is seven hours removed.  
6 So, their day is our night, and their night is our day.  
7 You're going to have to be up an extended period of time  
8 when you're traveling. The timing of sleep is going to  
9 be affected by that and the quality of sleep is going to  
10 be affected by where you are.

11 Most travelers or people who travel find that  
12 they get sleep deprived progressively over time, because  
13 they can't get the same quality sleep. The best sleep is  
14 in your own bed in your own home in your comfort zone.  
15 And when you are staying in a hotel, then your sleep is  
16 typically a lot worse than it would be at home.

17 So, basically this is just making the point  
18 that we're used to being wide awake when the sun is out,  
19 and we are used to sleeping or being asleep when the moon  
20 is out, when it's nighttime. When you fly across the  
21 planet and arrive in another time zone, suddenly you are  
22 wide awake at night or you're fast asleep during the  
23 daytime.

24 And I don't know if anybody has seen the recent  
25 Bill Murray movie about the trip to Japan where everybody

1 is walking around as a zombie. I have just seen that  
2 movie. But that is a situation with jet lag that  
3 travelers are in. That is the type of situation that you  
4 get into.

5 So, here we show the effects of jet lag on  
6 travel fatigue. The jet lag is -- what it means is that  
7 -- it used to be when people traveled, they traveled by  
8 boat up until the 1950's. And in fact, when I came over  
9 to America for the first time -- this dates me a little  
10 bit -- but I actually came over by ocean liner. And  
11 every day -- we took nine days to do the crossing from  
12 England to come over to America. And every day or most  
13 days you started up an hour earlier. And that was kind  
14 of nice because you adjusted very slow.

15 Then when the jet planes came, suddenly in four  
16 hours you can be in a different time zone. Now you have  
17 the problem where you can't adjust. Your body can't  
18 adjust quickly. That is the problem with jet lag. So,  
19 you have a disrupted sleep pattern. You build up this  
20 cumulative sleep depravation that builds up. You're  
21 eating at a dinner time when you don't feel like eating.  
22 And in the middle of the night when you can't get any  
23 food in Paris, that is when you really start feeling  
24 hungry. You get this general feeling of malaise.

25 And one of the very important things, as you

1 get into this, is you actually lose reference points.  
2 You don't realize how tired you are. It's very  
3 noticeable with jet lag traveling and shift workers.  
4 They think they are normal. They think they are okay  
5 because you just get used to it. You don't realize how  
6 fatigued you are, and you tend to under judge how  
7 impaired you are. As a result you don't have good  
8 anticipation. You make mistakes. And there is certainly  
9 a lot of evidence showing increased risk of having  
10 driving accidents and problems with driving.

11 Q Now, what is this chart showing us here? We  
12 are getting more into as it relates to alcohol?

13 A That is right, yes.

14 One of the -- one of the very important  
15 findings was made by an Australian researcher in 1997  
16 called Drew Dawson. He discovered that exactly the same  
17 problems with fatigue or sleep deprivation were occurring  
18 with alcohol. He did a very simple test. He took a  
19 group of people, and one week he gave them alcohol to  
20 drink and got their blood alcohol up to -- up to a .08 or  
21 .10 -- up to the sort of levels that would be judged as  
22 driving under the influence type of levels. And he  
23 measured also all sorts of reaction times and ability to  
24 drive a car, ability to do various tests.

25 And he found, of course, that people get more



1 and more impaired the more alcohol you have.

2           Then he went the next week after they recovered  
3 and he took the same group of people and now what he did  
4 is he just kept them awake 24 hours straight. And what  
5 he found was that the same effects occurred. That -- you  
6 know, that really, it's just like alcohol, as people got  
7 out of the 24 hours awake or the 24 hours continuously  
8 awake. Now, this is a very interesting finding, and it's  
9 seen by repeating it.

10           One of the very important things about science  
11 is one person's findings you can't rely on, but it's now  
12 being repeated by researchers in England and researchers  
13 at Stanford in the United States. It's a major piece of  
14 finding that is actually helping us understand that  
15 fatigue or sleep deprivation, being up 24 hours straight,  
16 is as dangerous as drinking and has the same sort of  
17 effects.

18           And what is kind of interesting is that most of  
19 the things that we use to judge whether a person is drunk  
20 or whether they're sleep deprived -- actually with those  
21 some tests come out just about the same. So, in other  
22 words, it just looks like the person is drunk. And this  
23 has been a rather new piece of finding, and it's only  
24 just becoming that people are aware of it. But it's  
25 very, very well established scientifically.

1           Q     Is this type of research leading states in the  
2 United States to literally criminalize people operating a  
3 truck or a motor vehicle when they haven't slept for long  
4 extended periods of time?

5           A     Yes, it is. In fact, this summer the State of  
6 New Jersey just published or just passed a statute or a  
7 revision to the statute to deal with drunk driving to add  
8 24 hours of sleep deprivation as an equivalent. In other  
9 words, if you kill someone and if you have a traffic  
10 accident and someone dies in the State of New Jersey as a  
11 result of your traffic accident, and you have been awake  
12 for 24 hours, it's as though you had a blood alcohol of  
13 .08.

14                     So, this science has been very enlightening.  
15 And the state of New Jersey has been the first state to  
16 pass that.

17           Q     This slide here, you said many of the things  
18 that were used to decide whether or not somebody is  
19 drunk --

20           A     Right.

21           Q     -- would mimic exactly the same symptoms and  
22 outward appearance as someone that is sleep deprived.  
23 This chart that is being shown to the jury right now, is  
24 this one of the tests?

25           A     Yes. This is an example of one of the tests.

1 One of the things that police officers do when they're  
2 testing with so called standardized sobriety tests is  
3 they ask someone to stand there and close their eyes and  
4 they distract them by having them count. But what they  
5 are really doing -- one of the key things to doing this  
6 is to see if they wobble on their feet. And if they  
7 wobble -- all of us wobble more when we are on one foot.  
8 But there is increased wobbling when you have alcohol.

9           There is a very important example where you  
10 take people who are not sleep deprived and ask them to  
11 stand on a mat. You see, this is an electronic mat. And  
12 we can actually record, looking downward from the head,  
13 where the center of -- the exact center of gravity of the  
14 body. So, in other words, when I drift forwards and  
15 backwards, that will show as a signal on the mat. And  
16 so, you can see when a person is not sleep deprived and  
17 they have had a full night's sleep and so forth, they can  
18 balance pretty well on two feet with their eyes open.  
19 And with eyes closed there is more wiggle. And when you  
20 go to one foot, of course, there is more. No one can  
21 balance quite as well on one foot as two. That is why we  
22 were given two feet, I guess.

23           But then, of course, when you do the same  
24 thing, identically, with the same people but now they are  
25 sleep deprived, you can start to see their wobbling much

1 sort of a stagger or sway in that person?

2 A Yes. Yes, that is right.

3 Q And if you close -- if you close your eyes it  
4 gets worse. And then with one foot it gets even worse  
5 still. And this person where the person is literally --  
6 I mean, can you look at that and say that that person is  
7 probably on his way to literally falling down?

8 A Yeah. If he was going over there he would be  
9 falling over. That is right.

10 Q And the only distinction between this person  
11 verses this person is the amount of sleep that they have  
12 had?

13 A Absolutely. That is the only thing.

14 Q There is no alcohol in this research?

15 A No. No.

1 showing us?

2 A This shows what are the signs that are observed  
3 from people who are sleep deprived and the studies that  
4 -- the many studies that have been performed in keeping  
5 people awake for 24 hours straight or more.

6 And when you keep someone awake for 24 hours  
7 straight they have watery eyes. They have slurred  
8 speech. They have problems with hand-eye coordination.  
9 They have problems with their balance, as we saw. They  
10 have problems with nystagmus. In other words -- that is  
11 this thing where your eyes start being jerky when you  
12 start tracking something outside. We get a jerky pattern  
13 called nystagmus. And they certainly have problems with  
14 driving performance. They drift off the road. They have  
15 more crashes. They have more accidents in driving  
16 simulators or on test tracks, people that are sleep  
17 deprived driving around one of the slippery tracks. It's  
18 too dangerous to do this. They knock over the cones.  
19 And they drift out of their lanes much more commonly.

20 So, all of these things have historically been  
21 related on police charts looking and evaluating in  
22 determining whether someone is intoxicated. In fact,  
23 they are not specific to alcohol intoxication. In fact,  
24 all of them are equally impaired by sleep deprivation.

25 So, with these studies you have to take into

1 going to his own house, could that be indicative of sleep  
2 depravation?

3 A Yes, it could.

4 Q And how would that happen? I mean, if I'm  
5 really tired how -- do I miss my turn or something like  
6 that?

7 A Well, one of the things that happens when  
8 someone is sleep deprived is you suffer from what are  
9 called micro sleeps. Literally you're fighting not to  
10 sleep. But you have these nod-off episodes behind the  
11 wheel. And they can be multiple seconds in length, five  
12 or ten seconds in length. Quite enough to miss a turn.

13 Also when you come out of a micro-sleep you're  
14 a little foggy. You are disoriented as to exactly where  
15 you are. So, you can get yourself often confused.

16 The other thing is that your ability to reason  
17 and think clearly and make good decisions -- like, I  
18 would, maybe, read the road signs here instead of  
19 guessing where I am going. Maybe I should look at a map  
20 or do something else. You don't think of those things.  
21 You get very narrow tunnel vision. You're just  
22 concentrating on trying to get there, and you lose that  
23 judgement or that way that you would normally compensate.  
24 So, you can't think your way out of a paper bag when  
25 you're sleep deprived.

1 Q And if we take somebody -- let's say somebody  
2 is highly intoxicated, I mean, when we talk about, like,  
3 a few minutes for them to be sober again -- how much time  
4 are we talking about if somebody is highly intoxicated?  
5 What is the amount of time for them to become sober  
6 typically?

7 A It depends on the blood alcohol level. But it  
8 occurs over quite a number of hours for the alcohol level  
9 to come down, depending on what the initial alcohol level  
10 is.

11 But essentially you will see someone's blood  
12 alcohol -- and some of the studies, for example, on this  
13 have shown the blood alcohol, you know, dropping by, you  
14 know, tenths, by a gradual, small amount over a number of  
15 hours tracking it after the event. So, it takes a number  
16 of hours.

17 Q If a police officer with 21 years of experience  
18 said that person who's highly intoxicated -- that it  
19 would take many hours -- essentially they have to sleep a  
20 full night to sleep that off, would you agree with that  
21 opinion?

22 A I'm sorry. The question was to do with sleep  
23 deprivation?

24 MS. SICA: Your Honor, I will object to that  
25 question as comparative and compound.

1 Q Okay. I want to know how -- what the effects  
2 -- please tell the jury of the effects of fatigue --  
3 someone who's fatigued and then drinks on top of that.

4 A Uh-huh. Yes. The research on this is actually  
5 quite interesting. What it shows is that certainly if  
6 someone has a very high level of alcohol in their blood  
7 stream, that there is an additive effect. The two have a  
8 combined effect. But when there are low levels of  
9 alcohol and the drinking has been done quite a number of  
10 hours earlier with the low levels of alcohol -- the low  
11 alcohol actually acts as a stimulant and the performance  
12 on the tests get better. And a number of research  
13 studies have shown this.

14 So, in this situation we are talking about a  
15 situation where the drinks, you know, that were had on  
16 the plane way back at least four hours previously -- it's  
17 just a couple of small drinks. And what we have is that  
18 that data is compatible with -- if anything at all, they  
19 would cause, in fact, an improvement.

20 Now, that is, maybe, a little counter-  
21 intuitive. But that is what the research has shown.  
22 That when you have low levels of blood alcohol it's a  
23 little bit of a stimulant effect and can actually make  
24 you stay awake a little bit more.

25 Q Who told you there were drinks had on the



