STATEMENT OF DR. SALLIE BALIUNAS SENIOR SCIENTIST THE GEORGE C. MARSHALL INSTITUTE WASHINGTON, D.C.

Dr. BALIUNAS. Thank you. Mr. Chairman and members of the Committee, I am a research astrophysicist. The following statement is my personal view of the technical issues and does not represent any institutional position.

The following is drawn from the peer-reviewed literature and from the WMO reports.

Chart 1 on the easel--thank you--shows ozone fluctuations between 1957 and 1991 and these data are the northern hemisphere ozone measurements from ground-base stations.

The ozone decrease over most of the world that is everywhere but the Arctic and Antarctic has been stated as roughly three-tenths percent per year between 1978-'79 and 1994.

However, note three aspects of the ozone record.

First, accurately subtracting the large natural effects is difficult.

And, two, selecting starting points for the analysis over relatively short records affects the outcome.

And three, plotting the chart on this kind of scale magnifies very small changes.

Now because they cover a longer interval of time than the

satellite data, these data more clearly reveal the extent of natural variability. The record also indicates the level of natural variability before the 1970s, before any substantial anthropogenic impact on ozone.

Now ozone levels change by a large amount every year between spring and fall. Over Washington, D.C., ozone varies annually by 25 percent, some 80 times greater than the stated anthropogenic decline. An average season has been subtracted from the data in Chart 1, leaving other natural factors--for example, changes in the sun's ultra-violet output or changes in the upper atmosphere wind patterns of the earth, and any other trends.

Additional factors which are not currently corrected in records may also exist. For example, decades-long shifts in meteorological patterns.

Now the trends of ozone decline are usually established for two starting points--1970 and 1978 or '79.

In the records shown in Chart 1, 1970 is the year of maximum ozone level for the entire 34-year record, and 1978-'79 is a minor peak in the record.

Mr. ROHRABACHER. Excuse me for interrupting your testimony here.

So you are saying that the year that is being used to judge all the rest of the years on the amount of ozone was one of the highest levels of ozone.

Is that correct?

Dr. BALIUNAS. Look on the chart. The very highest peak there--maybe Debbie could point to the year 1970, and follow it up to the top, the very highest peak in this 34-year record. A minor peak of 1978-'79, fortuitously, when the satellites happened to be launched, or coincidentally.

Mr. ROHRABACHER. Okay. And you're suggesting that that skews the analysis?

Dr. BALIUNAS. That choosing those end-points in a very short record, if one does not understand all the physical causes of ozone change, does tend to skew the records, indeed.

Mr. ROHRABACHER. Thank you.

Dr. BALIUNAS. And the fact that the observed trends depends on the selection of end points means that the trend has some uncertainty and is not reliably determined.

Finally, Chart 1 shows the ozone fluctuations of a few percent on a greatly magnified scale. However, the zero point on the scale is missing. The total amount of ozone and its variations are shown in Chart 2.

These are the exact same data as in Chart 1 and show the ozone fluctuations in perspective, and again, the seasonal data, the large seasonal data, are missing.

Now as for the accelerated phase-outs, the observational evidence casts doubt on a substantial rapid thinning of

ozone over most--

Mr. ROHRABACHER. Excuse me, again. Can you tell us what you think the significance of that chart is?

Dr. BALIUNAS. The first chart shows that the small changes have been magnified on he scale. This chart shows the entire column of ozone above our heads.

Mr. ROHRABACHER. And your conclusion from that is? I'm not going to put words in your mouth. I just want to know what you conclude because I think I know what you conclude.

Dr. BALIUNAS. This is what the total amount of ozone looks like. One can draw one's own conclusion about the level of variability of several tenths percent per year, and determining that.

Mr. ROHRABACHER. It doesn't look like there's much variation.

Dr. BALIUNAS. It is difficult to see on this scale.

Mr. ROHRABACHER. Thank you.

Mr. EHLERS. Mr. Chairman, may I also ask a clarification on the chart?

Mr. ROHRABACHER. Yes. Certainly.

Mr. EHLERS. You said that this chart was the same as the previous one, except you're including the whole scale. But wasn't the first one percent change rather than--

Dr. BALIUNAS. That's right, rather than the entire column.

Mr. EHLERS. Now you don't have units on the first one. Are those percentage points? They're not Dobson units.

Correct?

Dr. BALIUNAS. That's right. The average Dobson level on the other one is slightly over 300. You can tell by looking at this chart, by looking at the mean level there, zero.

Mr. EHLERS. Right. But I'm just clarifying.

Dr. BALIUNAS. Yes. The other chart is percent change from the average.

Mr. EHLERS. And where it says minus two, it means minus two percent?

Dr. BALIUNAS. Minus two percent.

Mr. EHLERS. From the average.

Dr. BALIUNAS. Right.

Mr. EHLERS. Thank you.

Mr. OLVER. Mr. Chairman?

Mr. ROHRABACHER. Yes.

Mr. OLVER. As long as we're butting in here to clarify charts, may I do a little bit of that, too?

Mr. ROHRABACHER. That's absolutely fine, yes, sir.

Mr. OLVER. Dr. Baliunas, you just said--I think I heard you said a couple of times, the total amount of ozone.

When you say the total amount of ozone, is that meant to mean the total amount of ozone in the atmosphere integrated over all degrees?

Dr. BALIUNAS. The Dobson unit is a column, one centimeter square, to be specific, above the ground. This is averaged over the northern hemisphere of ground station.

Mr. OLVER. The northern hemisphere.

Dr. BALIUNAS. Northern hemisphere. It excludes the Arctic only from 30 degrees to 60 degrees north.

Mr. OLVER. So the data that you're talking about in this is an integrated set of columns from over the northern hemisphere--

Dr. BALIUNAS. From ground stations. From 30 to 60 degrees north, yes.

Mr. OLVER. Thirty to 60 degrees.

Dr. BALIUNAS. That's right.

Mr. OLVER. Only in the northern temperate zone.

Dr. BALIUNAS. That's right.

Mr. OLVER. Okay.

Dr. BALIUNAS. This would cover--this is land-based stations in North America.

Mr. OLVER. Are these data in your--

Dr. BALIUNAS. These are mentioned in the WMO report. They are included in my testimony.

Mr. OLVER. It's included in your testimony.

Dr. BALIUNAS. They are not my research. It's peer-reviewed literature, again.

Mr. OLVER. But just to make sure I understand. This is

just the northern hemisphere.

Dr. BALIUNAS. Right. Ground-base data, no ocean coverage.

Mr. OLVER. Could your aide show the previous chart again? It was on very briefly as I was coming back in, so that I might see.

Dr. BALIUNAS. That's the percent change from that mean.

Mr. OLVER. In that northern temperate zone.

Dr. BALIUNAS. In that same, right, northern hemisphere.

Mr. OLVER. Thirty to 60 degrees.

Dr. BALIUNAS. Right. And these two charts are included in the testimony.

Well, indeed, based on these small trends, the 1994 world meteorological executive summary, estimates the cumulative ozone impact loss in the next 50 years if all the CFCs currently contained in refrigerators, air conditioners, et cetera, were released.

Since most of the CFCs are already in the atmosphere, preventing the release of CFCs in existing equipment would have little effect.

In fact, it would avoid an additional maximum ultra-violet B exposure equivalent to a move 1000 yards closer to the equator.

Now the penalty for a four-year delay in the phase-out, what would the delay of setting back the manufacturing date for CFCs to the original year 2000 from 1996, cost in added

UV-B exposure.

Similarly, assume the maximum future loss of 1.5 percent as given in the WMO 1994 report for the northern mid-latitudes in summer and fall, and assume that loss, that maximum loss, is sustained for four more years.

The effect of that four-year delay would be equivalent to moving 20 miles closer to the equator for four years. Such small increases in UV-B are hardly significant when compared to the natural fluctuations in UV-B. For example, 50 percent seasonal changes.

Given the background of large natural fluctuations, such small increases in UV-B also cannot be reliably extrapolated to yield a small risk.

Mr. ROHRABACHER. Excuse me, again. I'm sorry for interrupting.

You say the seasonal changes. When is the season that is the maximum UV-Vs?

Dr. BALIUNAS. Spring, summer, fall.

Mr. ROHRABACHER. That's the maximum time of exposure, when we have exposure for human beings?

Dr. BALIUNAS. The maximum--let me get this exactly right.

Over Washington, D.C., ozone varies 25 percent.

Mr. ROHRABACHER. Right.

Dr. BALIUNAS. And it drops from the spring to the fall and then recovers the following spring.

Mr. ROHRABACHER. Okay. Now, let me put it this way, in another way.

The ozone layer is thickest in the winter or in summer months?

Dr. BALIUNAS. It is thickest in the--ozone levels drop in the spring. So it's thickest towards the spring in the northern hemisphere and drops in the fall.

Mr. ROHRABACHER. Okay. You can continue.

Dr. BALIUNAS. And, of course, the sun is changing at a slightly different angle. So the amount of UV-B exposure is maximum usually in the late spring, early summer.

Mr. ROHRABACHER. Okay. Go right ahead.

Dr. BALIUNAS. I'm finished. My last sentence, just to reiterate--the effect of the four-year delay would be equivalent to moving 20 miles closer to the equator for four years. Such small increases in UV-B are not significant compared to the natural variations of 50 percent at the latitude of Washington, D.C., and given this large backdrop, can't be extrapolated to meaningful levels of risk.

Thus, the delay of four years would entail no significant risk to public health.

Mr. ROHRABACHER. Dr. Setlow, we'd ask you to testify now. And then right after your testimony, we will then break for the vote and come back for the final witness, and then for questions for the whole panel.

I think that's probably the best way we should go about it.

Dr. Setlow?

[The complete statement of Dr. Baliunas follows:]

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