Debunking media myths about the ozone layer

Dr. Hugh W. Ellsaesser weighs the possible benefits of increased ultraviolet radiation against the claims that the 'ozone hole' spells the doom of man. Part II of an interview.

Dr. Ellsaesser retired from the U.S. Air Force Air Weather Service after 21 years as a weather officer and from the Lawrence Livermore National Laboratory after 24 years in climate research. He is continuing his studies at Lawrence Livermore as a Participating Guest Scientist. Rogelio Maduro interviewed Ellsaesser for 21st Century Science & Technology *on March 1.*

In Part I, published last week in EIR, *Dr. Ellsaesser looked systematically at the available scientific evidence concerning the "ozone hole"—a phenomenon which has become an environmentalist* cause célèbre. *In 1987, ministers of over a dozen nations drafted a global ozone treaty in Montreal, calling for a 50% cut in production of chlorofluorocarbons (CFCs) by 1998. Officials of more than 70 nations are currently meeting in London to draft a treaty mandating a complete ban on CFCs by the year 2000, on the grounds that these allegedly are causing a hole in the ozone layer. The "Chicken Littles" of the environmentalist lobby claim that a barrage of ultraviolet rays, unblocked by a degraded ozone layer, will start epidemics of skin cancer. Ellsaesser showed that the evidence for all of this is quite inconclusive.*

The theory that CFCs deplete the ozone layer was proposed by F. Sherwood Rowland in 1973 and was discounted by the scientific community. During the early 1980s, horror stories of "nuclear winter" abounded, which held that a nuclear war would cloud the atmosphere and cool the Earth such that the plant life to support any surviving humans would not be able to continue. Then, as the "nuclear winter" theory proved false, in 1985, the environmentalist lobby discovered that there was a hole in the ozone layer in Antarctica, supposedly caused by CFCs. No matter that scientist Gordon Dobson first noticed the hole in 1956 and deemed it a natural, seasonal phenomenon.

In this week's concluding installment, Ellsaesser goes further, to assert that if the benefits of CFCs are eliminated—notably their use in refrigeration—millions could die as a direct result. But the government and the media are not interested in this; neither are they interested in examining the related issue of the benefits of ultraviolent radiation. While the ozone layer blocks harmful ultraviolet rays, which can cause skin cancer, those same rays provide the human body with vitamin D, without which we cannot absorb calcium, which is necessary to maintain bone strength, and especially urgent in children and the elderly.

Q: Now back to the question of the high-level ozone, the ozone layer, which the environmentalists claim is essential to the existence of life on Earth. Most of the news media say that the ozone layer is less than half an inch thick, and in all the diagrams that I have seen in *Time* and *Newsweek,* they regularly show a very thin layer of ozone over the Earth.

Ellsaesser: If you reduce it down to standard atmospheric conditions—that is, the temperature and pressure we have here at the surface—you have about 300 milli-atmospheric-centimeters. That means 0.3 centimeters of ozone (about one-eighth of an inch) when the layer is compressed to standard temperature and pressure and you have nothing but ozone in the layer.

Q: Does this layer really exists in that way?
Ellsaesser: As a layer, yes—but not thin—it extends over tens of kilometers in concentrations of parts per million of the ambient air. But it's very important. It screens out the very energetic part of the ultraviolet light. . . .

Q: What I am asking is this: When people see the diagrams, they think of the ozone layer as something very fragile, and this frightens them.
Ellsaesser: It is being presented as if it were compressed to standard atmosphere conditions, but it is actually mixed into the atmosphere over a great depth. It extends from the tropopause up to something like 70 km. It's very rugged. It has been there ever since the atmosphere developed with oxygen in it. However, before we had an oxygen atmosphere, it probably was not there. In other words, until we had developed an atmosphere containing oxygen—and part of that oxygen was converted to ozone by ultraviolet light from the Sun—the radiative environment on land was such that no animal or plant could have survived.

So we had to have the oxygen atmosphere, which then developed the ozone atmosphere, before life could move out of the water onto land. The estimates of the amount of ozone required for that evolutionary step to occur—estimates that were made before the SST or any other ozone arguments came along—is roughly one-tenth of the present level of ozone. In other words, we could reduce our ozone screen presumably tenfold without having too great an effect on our ability to live here.

Q: So you mean that a very significant reduction of the ozone layer would still permit people to live here.
Ellsaesser: Yes. They would undoubtedly have to take protective measures in some areas. In Indonesia now, when Dutch people go there and live at higher elevations where it's cool, they have to be very careful to protect themselves from ultraviolet. They get severe sunburn and skin damage; they just can't tolerate it. It would be like going up on top of a mountain here and staying out in the Sun.

Q: What is the amount of ozone—the thickness of the ozone layer—and the amount of ultraviolet that reaches the people at the equator, as opposed to people in New York City, for example?
Ellsaesser: On an annual mean basis, from the pole to the equator ultraviolet increases roughly 50-fold. The doubling distance is roughly 1,000 miles. So it's roughly four to eight times more at the equator than what we get. That does not take account of the fact that there are other things in the atmosphere that help screen out ultraviolet. For example, in the tropics you have lots of moisture particles—more than you have here—which also help screen out ultraviolet.

Q: But the amount of ultraviolet that is received at the surface is about eight times larger at the equator than in New York City.
Ellsaesser: On an annual average, yes.

Q: And people at the equator have managed to survive!
Ellsaesser: Yes. But you'll notice that people who developed in those climates, had dark skins. And in Scandinavia, on the other hand, where there is very little ultraviolet for vitamin D production, they had very light skins. In other words, we humans *adapted* to our ultraviolet environment by changing the pigment in our skin. People in low latitudes who absorbed too much ultraviolet and damaged their skin and those in high latitudes who didn't absorb enough to develop good skeletons basically didn't survive to reproduce. If they moved slowly from one latitude to another, the advantages and disadvantages would have been more gradual, but the people with the proper amount of skin pigment would still have had a survival advantage and gradually have become the predominant survivors.

But now people are beginning to move quite rapidly all over the globe. So we have dark-skinned people in high latitudes who are developing rickets because they don't get enough ultraviolet to develop the vitamin D they need. And we are getting light-skinned people, like those who went to Australia, who are getting more ultraviolet than their inherited skin pigment is adapted to, and they are showing the highest skin cancer incidence in the world.

Thinning the ozone layer will help the dark-skinned people who migrated to higher latitudes, but it will make the skin cancer problem worse for those like the Australians. We have to keep track of where we are and whether we need to do more than rely on our inherited skin pigment to take care of us.

Q: Does this mean that what the environmentalists are most afraid of is that we'll all become dark-skinned people if the ozone layer is depleted?
Ellsaesser: Well, I think they are being racist because only white-skinned people suffer particularly from excess ultraviolet.

Q: I think the other fundamental point is, obviously, as long as there is ultraviolet light, sunlight, and there is oxygen, there will be an ozone layer. . . . Now, would it not be dangerous if there were no mechanisms to deplete ozone, and it just kept on being created from oxygen by the ultraviolet light? Don't there have to be some natural mechanisms?
Ellsaesser: But there are. It's already self-limiting. It's a very reactive chemical.

Q: Self-limiting—you cannot produce any more ozone?
Ellsaesser: Not unless you change the ultraviolet flux of the Sun, or something else like that.

Q: Why is that?

"We put out money to investigate the detrimental consequences of man's actions. But for some reason, everybody thinks it would be immoral and illegal to spend any taxpayer money to document the possible beneficial effects of our actions. So we are biasing our decisions."

Ellsaesser: Once you have an oxygen atmosphere and a certain ultraviolet flux from the Sun, the ozone layer is established. There is a certain rate at which ozone is produced and a certain rate at which it is destroyed, and the ozone increases until the destruction rate matches the generation rate. The point at which equilibrium occurs is sensitive to such things as temperature and the distribution of solar energy by wavelength.

But the biggest factor in the total depth of the ozone layer is transport—air motion. There is much more ozone near 60° latitude than over the equator—and in winter than in summer—that is, just the opposite to what you would expect from the amount of ultraviolet. Most of the stratospheric ozone is essentially in storage—chemically inactive—in the lower polar stratosphere.

Such things as oxides of nitrogen, of hydrogen, of chlorine and of bromine, by setting up catalytic destruction cycles, may shift the chemical equilibrium point at different altitudes where ozone is chemically active. But the effects are substantially less than originally thought, simply because all of these catalytic ozone destroyers also interfere with each other. This may well be why observational confirmation of catalytic destruction of ozone cannot yet be claimed.

Q: How is ozone destroyed naturally?
Ellsaesser: The primary way in which it is destroyed in the stratosphere is by ultraviolet light. The primary way in which it is destroyed in the troposphere is by interaction with particles—that is, solid objects—at the surface of the Earth.

Q: How high up in the stratosphere do you find ozone from the surface of the Earth?
Ellsaesser: Oh, you find it all the way up to something like 80 or 90 km. There is some above that, but it has only been measured up to about 70 km that I know of. But the interesting thing about this is that from the surface of the Earth, the ozone increases steadily up to the tropopause, that is, the lower boundary of the stratosphere. You may find some oscillations, or blips, in it where there are layers that don't mix too well, but there is an increase with altitude. So the major process that is going on is that ozone is being formed in the stratosphere; it is descending through the polar tropopauses in the springtime when you have the breakup of the polar vortex, and then is diffusing down to the surface of the Earth, where it is destroyed.

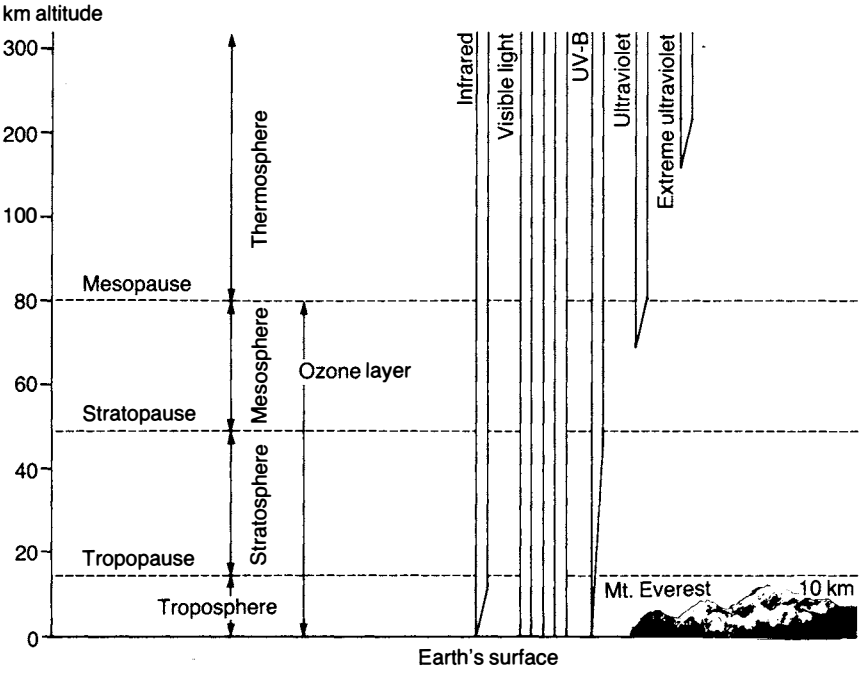
There is another process, the so-called smog photochemistry, which goes on in the boundary layer at the surface. There the impinging ultraviolet that gets through the stratosphere goes on to cause a reaction and generates ozone in the boundary layer. But this ozone in the boundary layer is also usually destroyed in the boundary layer. It's a diurnal process; it increases during the daytime and is destroyed at night.

Q: Does this mean that, nightly, the amount of ozone at the lower levels will go down?
Ellsaesser: It typically goes to zero every night at the Earth's surface over land. Over the oceans it may actually be coming out of the ocean.

Q: And how about in the stratosphere?
Ellsaesser: No. There is a relatively small diurnal variation in the stratosphere. Of course there are seasonal variations, but the seasonal variations in the stratosphere are primarily due to the movement of the air containing different amounts of ozone, rather than to photochemistry. In winter, tropical air containing high mixing ratios of ozone drifts polarward and downward, building thicker layers of air with a high content of ozone—so the total amount of ozone in the column becomes much larger than in the tropics where the ozone is actually generated.

Q: One thing that I find very curious—and I haven't noticed anybody making a major point of this—is that the time that the ozone hole occurs in Antarctica is right about the end of the six-month polar night, during which there is no ultraviolet radiation coming in. Would you not expect the ozone level to go down because you don't have ultraviolet light?
Ellsaesser: If there were particles or something there that could destroy the ozone, you would anticipate that. But the ozone molecules have to make contact with some kind of a solid to be destroyed, as they do at the Earth's surface. Normally, ozone is not destroyed significantly by anything we find in the stratosphere in the absence of sunlight. As I mentioned earlier, in higher latitudes ozone is essentially in storage. Remember that in the stratosphere, ozone is present in parts per million—almost everything else that might attack it is in parts per billion or less.

Layers of the atmosphere and penetration of sunlight



This figure shows the different layers of the atmosphere and the penetration of different wavelengths of sunlight through them. The ozone layer, where ozone molecules, O_3, are created and found, extends from the surface of the Earth to approximately 80 km altitude. While the highest concentration of ozone molecules are found at the bottom of the stratosphere, around 30 km altitude, most popular press have incorrectly drawn an imaginary thin line at 30 km altitude, as if that were the layer's location.

How much and what wavelengths of electromagnetic radiation penetrate the atmosphere is determined by atmospheric absorption within the spectral region in question: Some infrared and all visible light reaches the Earth's surface; ultraviolet and and extreme ultraviolet are entirely absorbed in the upper atmosphere. Longer wavelengths in the ultraviolet range, called UV-B, reach the Earth's surface.

Source: NASA

Q: So six months would not be enough for it to drift down to the surface of the Earth and be destroyed?

Ellsaesser: No. If there is a destruction process, it would have to be something like this: Particles of ice crystal clouds take up (sublime) the nitric acid vapor—which is what oxides of nitrogen become in the wintertime when there is no sunlight—and grow enough to precipitate. When the Sun comes up the following spring, the nitric acid cannot be converted back to oxides of nitrogen so they could chemically tie up the chlorine. This leaves the chlorine free to attack the ozone, and it may be what's going on in the ozone hole region over Antarctica. But, at the present time, I think it is still somewhat questionable that that is an important part of the process. However, it can't be ruled out either.

Q: Is it therefore warranted to impose such an onerous tax on CFCs or to ban them, based on this?

Ellsaesser: If they ban freon, we've got a lot of automobiles with air-conditioning equipment that will not be replaceable. I don't think many are going to go to the expense that it will take to put in the new type of equipment that will have to be used for the new types of chemicals they are coming up with. The same type of problem will occur with all of our refrigerators and air-conditioning equipment in homes and offices. Unless we are all more affluent, fewer of us will be able to afford air conditioning and refrigeration. There is going to be a substantial reduction in the use of it. That is going to have a health effect. I don't know anyone who has looked at that particular health effect and tried to balance it against the one they are worried about.

Q: Some individuals have denounced the ban on CFCs because it will mean that millions of people in the Third World will die as a result of food poisoning because of the lack of food refrigeration.

Ellsaesser: I think that is probably true, because at the time that we introduced refrigeration in this country, there was a very rapid drop in the mortality rate from such things as stomach cancer. However, the *big* problem with food—because it tends to be produced sporadically—is keeping it edible until the next hunt or harvest.

Q: Therefore, ostensibly to save a few lives that might be lost from increased ultraviolet radiation, perhaps millions will die?

Ellsaesser: Yes. That has already happened with DDT. They just haven't looked at all of the ramifications of this and, as I said, I think that the slight destruction of ozone that *might* be occurring from freon chlorine, could very well be a net benefit to humans and to other vertebrates here on Earth.

Q: That benefit still has to be documented, correct?

Ellsaesser: Yes. No one is paying for that research to be done. That's the crime of the present U.S. government regulations. We put out money to investigate the detrimental consequences of man's actions. But for some reason, everybody involved thinks it would be immoral and illegal to spend any taxpayer money to document the possible beneficial effects of our actions. So we are biasing the decisions, because we don't have the other side of the question looked at and evaluated, and the data developed that we need to make a sound decision.

Sherwood Idso claims that there are already benefits for the biosphere from the increased carbon dioxide content of the atmosphere. He lists about half a dozen of them. One of them shocked even me. He claimed that the decrease worldwide in coronary mortality over the last two decades may very well be due to the rise in carbon dioxide content of the atmosphere. I don't know of any way to rule that out, because it is more consistent with the observation data *available* than is greenhouse warming itself.

The only way to find it out is to have people look into it, and that means somebody has to pay their salaries. If the government is not willing to fund research into this type of question, it is going to continue to bias the conclusions and take us off into the very expensive type of mistake we are now headed for.

Q: Has anyone calculated how many millions of people will die as a result of a ban on CFCs?

Ellsaesser: Not that I am aware of, but I think, if you used the types of approach that the environmentalists have, you could easily come up with a very big number. It's just like taking smog out of Los Angeles. Nobody is complaining about the fact it's going to increase ultraviolet and skin cancer down in Los Angeles. The problem is that all of our communications, including the scientific ones, have put in a one-way filter, because the government has become the main source of research funds. They are biasing the decisions by looking only at one side, the detrimental side.

Q: But how could the environmentalists get so much government funding when other scientists cannot?

Ellsaesser: Well, it developed historically. Ever since Rachel Carson's book *Silent Spring* appeared in 1962, the attitude has been that the only thing that is important is looking at the detrimental effects—the possibility of beneficial effects was not admitted. That is, *man can do no right*.

Of course, that's the thing the news media love to publish, the thing you can use to scare money out of Congress to get research funds. So the system developed in that way, not necessarily because of the environmentalists, but just because that's the way humans are. We play the *rules* and not the game.

But now the environmentalists are trying to exploit the situation, and the government has got itself into the act where it is biasing the decisions by looking only at the detrimental effects. It's not spending any money for research on the other effects—the other side, such as the Idso material that I mentioned on heart attacks. There is also Dr. Don Luckey, who used to be at the University of Missouri, who has collected some 300 studies that show that there is a beneficial effect of radioactivity for levels up to about 10 times what we consider to be background. According to his data, we would all be better off—healthier—if we were exposed to 10 times more radioactivity than we are getting at the present time.

For years, Luckey kept trying to get the government or someone to fund a research study in which he would take mice underground in a mine to protect them from cosmic rays. He would shield them with lead to protect them from the uranium and radium in the Earth. He would replace the potassium-40 in their bodies to protect them from self-radiation from that, and thus raise them in a very low-radiation environment. He had hoped to prove by this process that the slope of the health effects curve for radioactivity is negative at the background level. In other words, he predicted that these mice would be less healthy than those exposed to normal radioactivity. No one wants to touch that!

He hasn't been able to get anybody to pay for a study. He's done a little bit on his own, on microbes and bacteria, which tends to support it, but it's not the type of thing that most people would accept. He wants to run a full-scale experiment with enough mice or animals to make it hard to discount his results, and that takes money.

Something else. I don't think you have ever heard of the so-called mega-fish experiment. People always talk about mega-mouse experiments, because it takes millions of cases to detect these very small effects they are looking for at levels of radiation near background. Well, here on the West Coast at the salmon fisheries, they have exposed 600,000 salmon fry to 25 rems of radioactivity before they were released, and released another 600,000 without any such exposure. They tagged them all, and kept track of them as they came back. They found that 20% more of the irradiated ones than of the unirradiated ones made it back. This suggests that the radioactivity gave them some sort of a living advantage out there in the ocean where they all lived.

I have never found anybody who has heard of this experiment except my original source, Don Luckey. . . .

Q: What would you suggest be done to have rigorous scientific evidence?

Ellsaesser: They should acknowledge this bias and either fund the other side of the equation or stop funding the investigation of the detrimental effects that people keep proposing. One of the two. In other words, don't bias the results. If you are going to fund one, fund the other. If you are not going to fund the other, then stop funding the one. It is the bias that's leading to problems. . . .