Weinberg: director of first think tank to study global warming

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Carolyn Krause brings us the third and final installment of her series featuring our own Alvin Weinberg. She has shown us the historic involvement he had with the world's first atomic reactor, the CP-1 experiment led by Enrico Fermi and built beneath the Stagg Field at the University of Chicago.

She then followed Alvin to the Clinton Laboratories in 1945 which evolved into the Oak Ridge National Laboratories in March 1948. She reminded us that he became the Research Director, also in 1948, for seven years and the Director of ORNL in 1955 for 18 years until 1973. In this final article Carolyn focuses on Alvin's 15 years with the Oak Ridge Associated Universities and his leadership of the Institute for Energy Analysis.

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Almost 20 years ago, global warming induced by growing concentrations of carbon dioxide in the atmosphere became the chief issue in U.S. energy and environmental policy. Alvin Weinberg, director of a think tank in Oak Ridge, played an important role in waking up the government to the issue.

In summarizing the accomplishments of the Institute for Energy Analysis (1975-90) that he founded and led at Oak Ridge Associated Universities, Weinberg wrote that "our tiny group sparked the government's first serious effort to deal with global warming, and we were the first to try to address the social impact of carbon dioxide." The summary appears in his 1994 book *The First Nuclear Era: The Life and Times of a Technological Fixer*.

Weinberg and IEA weren't the first to bring up the issue. As a member of the President's Science Advisory Committee for Presidents Eisenhower, Kennedy and Johnson, Weinberg was aware of the 1965 PSAC report in which Al Gore's mentor Roger Revelle reminded the government of the 1896 prediction of Swedish scientist Svante Arrhenius.

Arrhenius and Thomas Chamberlin, who made the calculations, stated that burning fossil fuels continuously to meet energy needs would eventually cause the earth's climate to warm by some two degrees Celsius. They predicted that doubling atmospheric CO2 would raise the earth's surface temperature by five degrees.

In the 1970s Jerry Olson, an ecologist at Oak Ridge National Laboratory (of which Weinberg was director from 1955 to 1973), focused on the global carbon cycle. Olson tried to tease out the ways that green plants pull carbon from the atmosphere's CO2, incorporate it into their leaves and wood and then return the carbon as CO2 when the plants die.

Weinberg was delighted when Ralph Rotty, a mechanical engineer and meteorologist, joined IEA in 1975 with a proposal to examine the effects on the earth and air of carbon dioxide. Rotty maintained contact with Charles David Keeling, who since 1958 had been annually measuring the growing burden of CO2 in the atmosphere, and with climatologists who attempted to estimate the resulting warming of the atmosphere.

The greenhouse gas CO2 absorbs infrared radiation reflected to the atmosphere from the earth's surface. Because warmer air holds more water and melts glacial ice faster, climatologists believe a warmer climate could have disruptive effects.

After Rotty made Weinberg aware of Keeling's observed increases in atmospheric CO2, Weinberg was encouraged because the first nuclear era was drawing to a close in the U.S. No new nuclear power plants were ordered for three decades after the Three Mile Island nuclear power plant accident in 1979.

"Since nuclear power plants, once built, emitted no carbon dioxide, could not the carbon dioxide buildup become a new, powerful justification for reviving nuclear energy?" Weinberg wrote in his

book. So, he went from office to office in Washington, D.C., arguing that the government must "pay attention to carbon dioxide" and "preserve the nuclear option."

Robert Seamans, head of the Energy Research and Development Administration (predecessor of the Department of Energy), responded to Weinberg's pleas by establishing within ERDA a carbon dioxide effects office.

"And our IEA was assigned the responsibility of assessing the impact of the increase in carbon dioxide," Weinberg wrote. "From 1976 to 1984, the IEA became the nation's center for matters connected with carbon dioxide. We would convene meetings of carbon dioxide researchers from all relevant areas – climate models, carbon-cycle modeling, economic implications, agricultural and ecological implications, even political implications."

In his book Weinberg pointed out questions whose answers still remain uncertain, such as how would CO2 increases affect the climate, including temperature and rainfall, and would melting of polar ice sheets raise the sea level significantly?

Gregg Marland worked at IEA for several weeks with the famous theoretical physicist Freeman Dyson of the Institute for Advanced Study at Princeton University. The two published a paper in which they estimated that the 25 billion tons of carbon dioxide injected annually into the atmosphere could be removed if a trillion trees per year, or 200 trees per person, were planted.

Marland, who later joined the ORNL staff and now teaches at Appalachian State University in Boone, N.C., has been long regarded "as one of the world's leading carbon dioxide gurus," as Weinberg put it.

In the March 25, 2009, issue of the New York Times Magazine, Nicholas Dawidoff wrote an article on Dyson titled *The Civil Heretic*. Dyson criticized climate-change specialists who speak of addressing global warming more as an ideology than a science.

Dyson is skeptical about general circulation models. He has argued that some scientists are true believers who make predictions with such confidence that they believe them without sufficient evidence.

Nuclear power is at a crossroads now because of the March 11, 2011, nuclear power plant accident at Fukushima following the Japanese earthquake and tsunami that killed 23,000 people. No one has died so far from the accident, but 80,000 people had to evacuate their properties because of the released radiation.

Many environmentalists concerned about global warming want to shut down fossil sources of electricity and replace them with renewable energy sources, such as solar and wind, but not new nuclear power plants.

But, according to Professor Richard Lester of the Nuclear Science and Engineering Department at the Massachusetts Institute of Technology, smart, young, dedicated, environmentally conscious Americans are studying nuclear engineering in greater numbers.

They see the use of new nuclear reactor designs as an opportunity to address the 50 percent increase in energy demand expected worldwide over the next 20 years and to achieve deep reductions in carbon dioxide emissions to avoid the worst aspects of climate change.

Former MIT graduate students and entrepreneurs Leslie Dewan and Mark Massie have started Transatomic Power for building and marketing the Waste-Annihilating Molten Salt Reactor (WAMSR). Their invention is based on the molten salt reactor developed and tested at ORNL in the 1950s and '60s under Weinberg's leadership.

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The WAMSR is smaller, safer, cheaper and more powerful and portable than today's pressurized water reactors. According to the WAMSR website, "At full deployment, our reactors can use [as fuel] existing stockpiles of nuclear waste [dissolved in molten salt] to satisfy the world's electricity needs through 2083."

Since China has 14 nuclear power reactors, 27 under construction, 51 planned and 150 proposed, China may someday be buying molten salt reactors MADE IN AMERICA. As a man of the world who was concerned about its energy future, Weinberg would likely approve.
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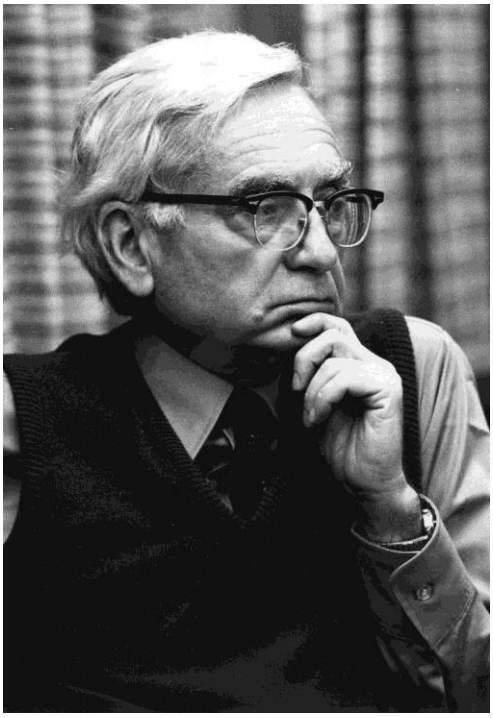
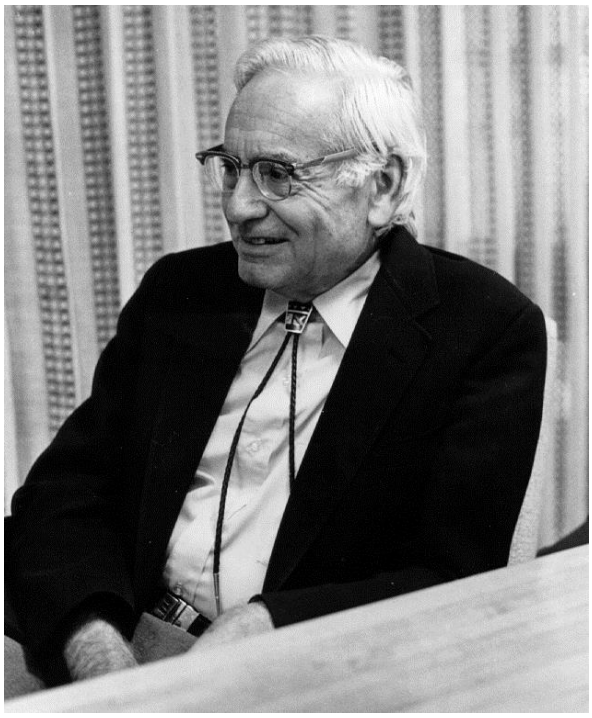
Thank you again Carolyn. This series of three *Historically Speaking* columns has given us insights into Alvin Weinberg and his accomplishments during his career, especially during his time in Oak Ridge. Again, I remind us that Alvin Weinberg was one of our treasured scientists…we should honor him and recognize him in prominent ways.

As I mentioned at the end of the first and second articles Carolyn wrote about Alvin Weinberg, there is a group of folks who are attempting to recognize Alvin Weinberg's accomplishments and to honor his memory in substantial ways. They can use your help to complete a film about Alvin's life. If you want to help fund that effort, please see Tom Row or Steve Stow.

If you can't reach them, contact me and I will help. 865-482-4224 or draysmith@comcast.net.





Alvin shown in his advancing years in a serious and a more relaxing manner
(Photos courtesy of ORAU)

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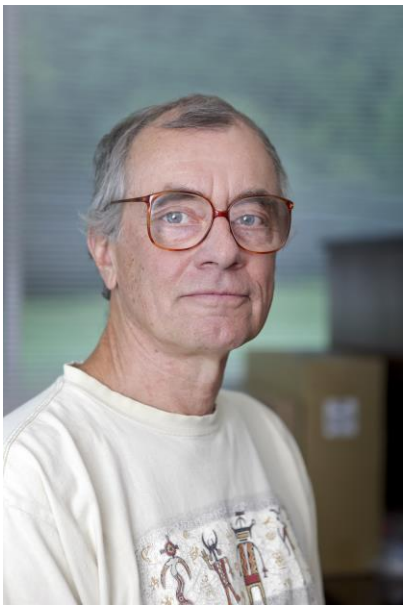

Gregg Marland, one of the world's leading carbon dioxide gurus – Alvin Weinberg (Photo courtesy of ORNL)

Gregg Marland and Janet Cushman examine a 324 year old Chestnut Oak tree slab taken from Chestnut Ridge near the Tower Shielding Reactor. The tree is dated by the annual rings to have been standing since 1648 – Galileo died in 1642! Wow, what a tremendous tree. This slab is located in Building 1505, Environmental Sciences, at ORNL. (Photo courtesy of ORNL)