Editorial

Keeping Our Cool

I didn't expect science fiction in the *New York Times,* but several weeks ago a story titled "How to Cool a Planet (Maybe)" seemed to provide it *(1)*. A week later I was pleased to see letters to the editor whose authors were as appalled as I was by the idea that global warming might need to be countered by major human interventions in the environment. The new scientific field of geoengineering explores ways in which the earth's environment can be altered on a scale similar to that of release of carbon dioxide from fossil fuels. One of the major motivations of the field is to discover what might be done should global warming become a crisis.

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Here are some ideas. Balloons could inject millions of tons of sulfur dioxide into the atmosphere, thereby forming a stratospheric cloud of sulfur particles that would reflect incoming solar radiation. Trillions of two-foot lenses could be placed in a stationary orbit between sun and earth so that they would refract some sunlight away from earth. Deserts might be covered with white plastic mulch or oceans with white disks to reflect solar radiation. Ships could spray mists of salt water into the atmosphere, producing tiny salt particles that would increase cloud formation and reflectivity. Iron could be added to the oceans to stimulate growth of phytoplankton, which would capture carbon dioxide from the atmosphere; when they died, the phytoplankton would carry the carbon to the bottom.

Ralph J. Cicerone, president of the National Academy of Sciences, suggests that such ideas need to be taken seriously as research topics and has intervened in favor of publication of a paper by Nobel laureate Paul J. Crutzen (whose prize was for showing how the ozone shield can be damaged) that examines risks and benefits of injecting sulfur into the stratosphere. There is no doubt that scientists should have the right to pursue subjects that interest them and to publish high quality research. Nevertheless, it is sobering to think about what might happen if the effects of large-scale environmental interventions were not correctly predicted. The history of environmental problems has shown that activities we once thought were benign can turn out to have unpredicted and dangerous consequences.

It is also somewhat depressing that those who are at the forefront of research on global climate change see a need to propose ideas that might be construed as science fiction. Strong evidence that humankind is profoundly affecting global climate have been available for some time *(2)*. That evidence has recently been confirmed by a National Academy of Sciences panel of experts *(3)*, which concludes, "It can be said with a high level of confidence that global mean surface temperature was higher during the last few decades of the 20th century than during any comparable period during the preceding four centuries." The panel finds a warming of about 0.6 °C during the 20th century and projects warming of from 2 to 6 °C during the 21st century. It is unfortunate that some have attempted to cast doubt upon the studies by Mann et al., even accusing them of intentionally selecting data or methods that would produce the result they wanted *(4)*. The findings of the NAS panel strongly suggest that the reasons for casting doubt were probably based on something other than science.

The draconian measures envisioned as antidotes to global warming will require huge inputs of research and development funds. Such funding is no more likely than what might have been spent during the past three decades to develop means for synthesizing renewable fuels such as ethanol from cellulose, for using solar or other renewable energy resources to generate electricity or hydrogen, or for any other approach than burning fossil fuels.

It appears that we are not doing a very good job of educating the public about the real consequences for future generations of continuing on the technological path we currently follow. As teachers we should consider which aspects of chemistry are the most important to future generations and carve out of our general chemistry and more advanced courses time to discuss issues like global warming in greater depth. Clearly these are far more important than solving another equilibrium problem or learning another named reaction. Perhaps we could attract more of the best and brightest students whose idealism and intelligence will be needed to alleviate problems such as global warming.

Literature Cited

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