LETTERS

Effects of Air Ions

The article by Marjorie Sun (News and Comment, 3 Oct., p. 31) reflects confusion about air ions in electrostatic precipitators (used worldwide for dust collection over the past 60 years) and ions discharged into the indoor environment for mood and dust control. The former use is well-documented in the scientific and engineering literature, but the manner in which the latter performs its alleged effects is a deep mystery.

In electrostatic precipitators, unipolar air ions are produced around a charged wire by a potential that exceeds the electrical resistivity of the air. Large numbers of these ions attach themselves to particles contained in the air passing close to the charged zone. After the particles become charged, they are attracted to charged collecting plates of opposite sign and removed from the flowing air stream. Unipolar air ions of negative or positive sign function equally well in electrostatic precipitators and both modes are in use.

Claims for the beneficial effects of negative ions released into occupied spaces go back at least to the 1930's and have ranged from mood improvement to peeling accumulated dirt from unwashed walls. Regrettably, there is no confirmation of these beneficial effects by unbiased evaluators (although those who fail to find merit in negative ions are invariably accused of stubborn bias by negative ion promoters). Most negative ion generators also emit copious quantities of ozone, formerly thought pleasant but now regarded as highly toxic. Ozone is the probable agent in the Russian observation that high concentrations of negative ions slow the growth of bacteria. In fact, machine vendors used to advertise that ozone deodorized and sterilized air. Manufacturers of some of the new models eschew bare ionizing electrodes and ultraviolet lamps and claim thereby to avoid ozone production, but negative ion production is likewise suppressed.

The psychological and biological effects of air ions have been reviewed by a number of investigators. Typically, these reviews include strong cautionary statements regarding past medical evidence (*1*). One investigator says, "The studies reporting incidental behavioral effect are far from perfect. Examination of these experimental studies indicates that they were deficient in instrumentation and control of interacting variables, and lacked a rational framework. Consequently, their results are equivocal and the magnitude and extent of ion effects on man's behavior is not clear" (*2*). Another says, "the experiments which have demonstrated a specific biological effect due to air ions generally do not remain definitive under critical review by other experimental physiologists" (*3*).

Yaglou (*3*) conducted two detailed studies of the effects of air ions on normal human subjects and concluded from the results of both that "On the whole, the results were essentially negative." This conclusion might have been expected in view of the fact that few light ions penetrate into the lungs; most are absorbed in the upper respiratory passages. However, Yaglou (*3*) reported that similar, negative results were obtained in studies of normal subjects exposed to heavy ions, which can reach the lungs; in experiments on the growth and activity of rats exposed to light ions; and in studies of hypertensive patients who were periodically treated with heavy ions for months or years.

Recent investigations by Kreuger (*3*) have shown that cilia of animal trachea respond to negatively charged oxygen by increased beat rate and to positively charged carbon dioxide by the opposite effect. These observations have been widely cited as proof that positive ions decrease lung clearance rates and are, therefore, important factors in the detrimental effects of air pollutants. Kreuger is not disposed to accept this interpretation and stated, as reported by Yaglou (*3*), that his "studies have been limited to so-called basic physiological aspects of the problem, so that it would be presumptuous of us to interpret our results in clinical terms." This appears to be an eminently sensible attitude to adopt with respect to possible biological responses to air ions in the environment.

Concerning the ability of negative ions to clean particles from the air by making "them settle onto electrically grounded surfaces such as walls and ceilings," it should be kept in mind that (i) most air ions carry a charge equivalent to a single electron, and therefore the effect on particle mobility is minimal in a noncharged field; and (ii) although walls and ceilings may be "grounded," they usually have little conductivity and quickly build up a persistent negative charge under negative ion exposure, repelling further acquisition of weak negative charges. It was clear from observing a vendor's demonstration of dust cloud settlement in a bottle placed on an ion generator that the dust-clearing action resulted from dust agglomeration by sonic energy produced by the machine and from rapid

sedimentation of the large clumps that were formed.

Sun states that "Academic scientists who study the effects of ions confirm that the generators clear the air." I have not in 35 years of practice as an academic scientist specializing in dust collection ever heard of one. Furthermore, I suggest readers contrast Sun's statement that "ions are snatched up by pollutants" with Corn's comment, "Almost all industrial and domestic activities which produce fine particle pollution also produce air ions" (*4*).

Is it any wonder that the claims quoted in Sun's article raise the hackles of scientists who have been trying for decades to counter the exploitation of mysterious air cleaning devices that are promoted with testimonials by the gullable?

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2. A. H. Frey, *IRE Trans. Bio-med. Electron.* (January 1961), p. 12.
3. C. P. Yaglou, in *The Air We Breathe*, S. M. Farber and R. H. L. Wilson, Eds. (Thomas, Springfield, Ill., 1961), chap. 19; A. P. Kreuger, in *ibid.*, chap. 19, discussion.
4. M. Corn, in *Air Pollution*, A. Stern, Ed. (Academic Press, New York, ed. 3, 1976), vol. 1, chap. 5.

Chemistry Computer Center

As representatives of the community most affected by the decision to scuttle the National Resource for Computation in Chemistry (NRCC) (Research News, 26 Sept., p. 1504), we feel compelled to make our view public regarding this example of public science policy in the making. Our own examination of the issue indicates that the decision of the funding agencies (the Department of Energy and the National Science Foundation) is at odds with the general sense of the chemistry community and, indeed, we find that the decision-making process has essentially ignored community input. In the interest of possible future ventures into "big science" in chemistry, we feel that the scientific public should become aware of the nature of science policy decision-making and how it reflects on performance and politics.

At the Las Vegas meeting of the American Chemical Society (28 August 1980), the NRCC User Association decided to poll its membership (1700 scientists on its mailing list) regarding the report and recommendations issued by the ad hoc committee appointed by the funding agencies to review NRCC performance. It was felt that such a questionnaire was necessary because the report had recommended drastic changes in the nature of the NRCC, and yet the community to be affected had not even been informed of the recommendations.

The first question asked was if enough time had elapsed for a reasonable judgment to be made on the future of the NRCC. The second was whether the NRCC should continue in its present form for a longer time before critical decisions are made regarding its operation. The third question was whether the respondent agreed with each of the five recommendations of the ad hoc review committee.

Of the 200 members who returned their questionnaires within 2 weeks of mailing, 68 percent felt that not enough time had been allotted for proper judgment and 69 percent felt that the NRCC should continue as originally constituted for a period of 2 to 3 more years before review. The strongest disagreements were with the recommendations that suggest substantial changes in the way the NRCC now operates (79 percent were against switching software development away from an in-house scientific staff to an external postdoctoral program; 73 percent were against transferring software distribution to the Quantum Chemistry Program Exchange; and 53 percent were against stopping support of both internal and external computational research).

Shortly after the questionnaires were mailed out, a decision regarding the fate of the NRCC that goes beyond even the review committee's recommendations was reported in the pages of *Science*. However, no official announcement has been made, and no stated rationale for the decision has been made public by the funding agencies. Not only did the disclosure in the *Science* article emphasize to us the necessity of making our findings known as quickly as possible, it highlighted the manner with which this public policy issue has been handled since its beginning.

We have sent the detailed results of our questionnaire to the funding agencies and have urged them to reconsider continued funding for the NRCC. We have also asked them to issue a public report detailing the rationale for any decision that is made regarding NRCC's future.

We see a real danger when funders, effecting decisions concerning a national scientific resource, do not fully regard