

**UNITED STATES DISTRICT COURT
FOR THE WESTERN DISTRICT OF NORTH CAROLINA
CHARLOTTE DIVISION**

GLOBAL PLASMA SOLUTIONS,

Plaintiff,

v.

ELSEVIER INC. and ELSEVIER LTD.,

Defendants.

Case No. 3:22-cv-00034-RJC-DSC

**MOTION OF DEFENDANTS ELSEVIER INC. AND ELSEVIER LTD.
TO DISMISS THE COMPLAINT FOR
FAILURE TO STATE A CLAIM UPON WHICH RELIEF MAY BE GRANTED**

NOW COME Defendants Elsevier Inc. and Elsevier Ltd. and hereby respectfully move this Honorable Court to dismiss the Complaint filed against them by plaintiff Global Plasma Solutions, Inc. pursuant to Fed. R. Civ. P. 12(b)(6), for failure to state a claim upon which relief may be granted.

This Motion is based upon the Memorandum submitted herewith and Exhibits A through Q attached hereto.

Respectfully submitted this the 15th day of April, 2022,

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**MEMORANDUM OF DEFENDANTS ELSEVIER INC. AND ELSEVIER LTD.
IN SUPPORT OF THEIR MOTION TO DISMISS THE COMPLAINT
FOR FAILURE TO STATE A CLAIM**

Defendants Elsevier Inc. and Elsevier Ltd. respectfully submit this Memorandum in support of their motion for dismissal of the Complaint filed against them by plaintiff Global Plasma Solutions, Inc. (hereinafter sometimes “GPS”), under Fed. R. Civ. P. 12(b)(6). The Complaint fails to state a claim upon which relief may be granted, either for defamation or for violation of the Unfair and Deceptive Trade Practices Act.

INTRODUCTORY STATEMENT

This case concerns an article in the scholarly scientific journal *Building and Environment*, published by defendant Elsevier Ltd. The article describes certain experiments undertaken by a group of scientists to test the efficacy of equipment manufactured by plaintiff GPS, and to test the degree to which it led to the formation of possibly harmful byproducts. The results of their experiments were not flattering to GPS.

Rather than suing the authors of the article, GPS has sued two entities, Elsevier Inc. and Elsevier Ltd. But Elsevier Inc. was not the publisher of the article by which GPS claims to have been defamed, and GPS has not alleged any basis on which it should be held liable. Therefore, the Complaint cannot stand against Elsevier Inc.

As for Elsevier Ltd., a company headquartered in the United Kingdom, it is indeed the publisher of the article in question. But being the publisher, as such, is not sufficient grounds for liability. Elsevier Ltd. is not like the typical media defendant – the newspaper publisher or broadcast company whose employees say things that give offense. The journal it publishes is peer-reviewed, meaning that editorial decisions for the journal are made by an independent editor and independent scholarly referees, none of whom is an employee of Elsevier Ltd. or in any way under its control. Yet GPS seeks to hold Elsevier Ltd. liable without even suggesting that the editor or any of the peer reviewers, let alone any of the authors of the article in question, were employees of Elsevier, or otherwise under Elsevier's control. There is no legal basis for such liability, and to impose liability would have far-reaching adverse consequences for scholarship.

Alternatively, GPS seeks to impose liability on Elsevier for what it calls a “sham” peer review process, without providing any evidence for the alleged “sham” other than that the process failed to detect the alleged shortcomings of the article. However, GPS fails to plead any facts that would permit the trier of fact to follow its leap of faith.

Furthermore, the article in question, “Evaluating a commercially available in-duct bipolar ionization device for pollutant removal and potential byproduct formation” (hereinafter the “Article”), is not even defamatory, properly read. It is a factual report of two experiments in which the authors attempted to assess the efficacy of plaintiff's product, and its conclusions consist of data and some opinions about the implications of that data. GPS picks fights with its methodology,

but the methodology is all explained in detail, easily visible to anyone in the narrow community of those with the skill to read the Article. Choosing flawed methodology (even if that were the case, which Elsevier does not concede) is not defamatory in any event, and certainly not when the “flaws” have all been disclosed.

The deficiencies of the Complaint are even starker given the context in which the article appeared. Prior to publication of the article, GPS had engaged in an extensive publicity campaign, claiming that its equipment would stop the spread of Covid-19 in buildings, and this campaign had begun to generate a backlash among skeptical scientists. The issue received press attention for obvious reasons, given the toll that the pandemic was taking on the public. As a result of all this publicity and commentary – much of it eagerly sought by GPS, until the tide turned against it – GPS is a “limited purpose public figure” that must show “actual malice” – knowledge of falsity, or reckless disregard for probable falsity – in order to prevail. And it must plead facts that, if taken at face value, would establish malice. Its Complaint fails to do so.

Finally, GPS’s claim under North Carolina’s Unfair and Deceptive Trade Practices Act fails because GPS and Elsevier have no business relationship, because no harm to consumers is alleged – and more fundamentally, because the UDTPA cannot be used to make an end run around the principles of defamation law.

LEGAL STANDARD

I. Under F.R.C.P. Rules 8 and 12, A Complaint Must Plead Facts That Show A Plausible Claim to Relief.

In order to survive a motion to dismiss under Rules 8 and 12 of the Federal Rules of Civil Procedure, a complaint must “contain sufficient factual matter, accepted as true, to ‘state a claim to relief that is plausible on its face.’” *Ashcroft v. Iqbal*, 556 U.S. 662, 678 (2009) (quoting *Bell*

Atlantic Corp. v. Twombly, 550 U.S. 544, 570 (2007)). The plausibility standard requires a plaintiff to demonstrate more than “a sheer possibility that a defendant has acted unlawfully.” *Id.* It requires the plaintiff to articulate facts that show the plaintiff has stated a claim entitling him to relief. *Id.*; see also *Francis v. Giacomelli*, 588 F.3d 186, 193 (4th Cir. 2009).

As the Fourth Circuit has explained,

[A] complaint must contain ‘more than labels and conclusions, and a formulaic recitation of the elements of a cause of action will not do.’ To discount such unadorned conclusory allegations, ‘a court considering a motion to dismiss can choose to begin by identifying pleadings that, because they are no more than conclusions, are not entitled to the assumption of truth.’ This approach recognizes that ‘naked assertions’ of wrongdoing necessitate some ‘factual enhancement’ within the complaint to cross ‘the line between possibility and plausibility of entitlement to relief.’

. . . [W]here the well-pleaded facts do not permit the court to infer more than the mere possibility of misconduct, the complaint has alleged -- but it has not ‘show[n]’ – ‘that the pleader is entitled to relief,’ as required by Rule 8. . . . [E]ven though Rule 8 ‘marks a notable and generous departure from the hyper-technical, code-pleading regime of a prior era, . . . it does not unlock the doors of discovery for a plaintiff armed with nothing more than conclusions.’

Francis v. Giacomelli, 588 F.3d at 193 (internal citations to *Iqbal* and *Twombly* omitted). As will be shown, the Complaint here fails to meet this standard.¹

ARGUMENT

I. GPS’s Claim Against Elsevier Inc. Is Deficient on Its Face.

Elsevier Inc. and Elsevier Ltd. are two separate corporations, one incorporated in Delaware with a principal place of business in New York, and the other in the United Kingdom with a principal place of business in the United Kingdom. The Complaint acknowledges this at Compl. ¶¶ 17-18. The Complaint, however, tries to yoke them together in common liability by the simple expedient of referring to them collectively as “Elsevier.”

¹ In one specific instance, discussed *infra*, the special pleading standards of Fed. R. Civ. P. 9(b), applicable to claims of fraud, also apply – and also are not met.

Yet as the Article, attached as Exhibit A to the Complaint (Doc 1-1, p. 2), shows, Elsevier Ltd. is the publisher of the Article. not Elsevier Inc. At the bottom of the first page of the Article the Court will see the following statement:

Published by Elsevier Ltd.

GPS makes no allegation that even suggests how Elsevier Inc., not being the publisher of the Article, could have any liability whatsoever for the alleged defamation. Elsevier Inc. does not magically become liable by dint of sharing the moniker “Elsevier” in its corporate name. This is not just a failure to meet the “plausibility” threshold required of federal pleadings; it is a failure to plead anything at all. The Complaint must be dismissed as against Elsevier Inc.

II. Elsevier Ltd. Cannot be Held Vicariously Liable for Alleged Defamation.

Nearly all the allegations and rhetoric in plaintiff’s Complaint are directed at the authors of the Article. But a publisher cannot be held liable for the actions of authors whose work it publishes unless they were acting within the scope of their employment. This is a classic application of the doctrine of *respondeat superior*. *Cantrell v. Forest City Pub. Co.*, 419 U.S. 245, 253 (1974). “Employment” in this sense goes beyond the standard salaried relationship; it is judged according to a thicket of rules that seek to draw a line between someone who acts as an independent contractor and someone who, regardless of how they are paid, is acting under the direction and control of someone else.

Thus, in *D.A.R.E. America v. Rolling Stone Magazine*, 101 F. Supp. 2d 1270 (C.D. Cal. 2000), *aff’d*, 270 F.3d 793 (9th Cir. 2001), the Court had to decide whether a writer who was commissioned by the magazine to write a story was sufficiently under the magazine’s control that his alleged knowledge of the falsity of his article could be imputed to the magazine. Applying what it called the “decisive test,” namely the “right of control over the mode and manner in which

the work is done,” the Court found he was not. *Id.* at 1279 (quoting *Brose v. Union-Tribune Publishing Co.*, 183 Cal. App. 3d 1079, 1082 (1986)). The writer had entered into a standard “contributor’s agreement” with *Rolling Stone*, and *Rolling Stone* did not control how, when, or where he did his writing on any article he was doing for it. Because *Rolling Stone* could control only the decision whether to publish the final article, and not when and how the article was written, the author could not be treated as an employee, and the magazine could not be held liable for his alleged defamation. *Id. Accord Secord v. Cockburn*, 747 F. Supp. 779, 787 (D.D.C. 1990) (alleged malice of book author cannot be imputed to the publisher or the publisher’s editor); *Price v. Viking Penguin*, 881 F.2d 1426, 1446 (8th Cir. 1989).

Against this background, consider the allegations of the Complaint as regards the identity of the Article’s authors. The authors are:

- Brent Stephens, a professor at Illinois Institute of Technology (“IIT”) (Compl. ¶ 2);
- Mohammed Haiderinajad, also a professor at IIT (Compl. ¶ 42);
- Yicheng Zeng, an IIT graduate student studying under Prof. Stephens (Compl. ¶ 43);
- Prashik Manwatkar, an IIT graduate student studying under Prof. Stephens (Compl. ¶ 43);
- Marina Beke, an IIT graduate student studying under Prof. Stephens (Compl. ¶ 43);
- Insung Kang, an IIT graduate student studying under Prof. Stephens (Compl. ¶ 43);
- Akram Ali, an IIT graduate student studying under Prof. Stephens (Compl. ¶ 43);
- Elliott Gall, a professor at Portland State University (Compl. ¶ 44);
- Aurelie Laguerre, a graduate student studying under Prof. Gall (Compl. ¶ 44); and
- Delphine Farmer, an assistant professor at Portland State University (Compl. ¶ 45).

Thus, on the face of the Complaint, not a single author is an employee of Elsevier or otherwise under Elsevier's control, and the Complaint makes no allegation to the contrary.² The Complaint does even allege that Elsevier commissioned the Article, let alone dictated its contents. The misdeeds that the Complaint, in vivid prose, alleges these authors committed cannot therefore be imputed to Elsevier.

As for the Editor-in-Chief of *Building and Environment*, Qingyan Chen, the only allegation against him is that he "failed to identify obvious errors" in the Article. Compl. ¶ 64.³ Even if "failure to identify obvious errors" were actionable conduct, there is again no allegation of employment or control by Elsevier. The Complaint identifies Chen as Professor Emeritus of Mechanical Engineering at Purdue University (Compl. ¶ 10 and Exh. B thereto, Doc.1-2), and nothing more.

The final group of individuals whose work the Complaint assails are the peer reviewers who reviewed the manuscript of the Article.

Peer review has been justly described as "a central . . . quality-control feature in the scientific enterprise." *Solarex Corp. v. Arco Solar, Inc.*, 121 F.R.D. 163, 167-68 (E.D.N.Y. 1988) (internal citations to testimony omitted). As the Supreme Court said in *Daubert v. Merrell Dow Pharm., Inc.*, 509 U.S. 579, 593 (1993), "submission to the scrutiny of the scientific community is a component of 'good science,' in part because it increases the likelihood that substantive flaws in methodology will be detected." Thus the fact of publication in a peer reviewed journal is "a

² In this sentence, and for the balance of this memorandum, Elsevier Ltd. is referred to as "Elsevier" for the sake of simplicity.

³ Indeed, GPS's long letter to Prof. Chen, asking for retraction of the Article, is couched as an appeal to a neutral scientific arbiter, not as an accusation of wrongdoing. (Doc 1-2, pp. 2-9).

relevant, though not dispositive, consideration in assessing the scientific validity of a particular technique or methodology on which an opinion is premised.” *Id.* at 594.

What, then, does the peer review process mean, for purposes of this action? Since plaintiff has cited in the Complaint an Elsevier webpage concerning peer review, it is appropriate to take a closer look at what appears on that web page.⁴

At the cited page, <https://www.elsevier.com/reviewers>, if one scrolls down and clicks on “The role of a reviewer,” one comes to a subpage, <https://www.elsevier.com/reviewers/role>. This page – reproduced in Exhibit A to Elsevier’s motion⁵ – explains what reviewers (and editors) do:

Reviewers evaluate article submissions to journals based on the requirements of that journal, predefined criteria, and the quality, completeness and accuracy of the research presented. They provide feedback on the paper, suggest improvements and make a recommendation to the editor about whether to accept, reject or request changes to the article. The ultimate decision always rests with the editor but reviewers play a significant role in determining the outcome.

This subpage also explains how peer reviewers are chosen. About a third of the way down the subpage one comes to the following text:

Typically, reviewers are invited to conduct a review by a journal editor. Editors usually select researchers that are experts in the same subject area as the paper. However, if you think you would be a good referee for a specific journal you can volunteer to review on our [Reviewer Hub](#). On the “[Volunteer to review](#)” section of the Reviewer Hub, you can search for the journal(s) of your choosing and click on “Review for journal” to indicate your interest. Please note that you should first complete your reviewer profile.⁶

⁴ Compl. ¶¶ 8, 61-63. As the Fourth Circuit held in *E. I. du Pont de Nemours & Co. v. Kolon Indus.*, 637 F.3d 435, 448 (4th Cir. 2011), documents incorporated in a complaint should be evaluated in a motion to dismiss. Here, GPS incorporated the web page by reference.

⁵ All Exhibits referenced in this Memorandum are exhibits to Elsevier’s Rule 12(b)(6) motion.

⁶ For their efforts, peer reviewers receive thirty days’ free access to two scholarly research services owned by Elsevier, Scopus and ScienceDirect, and discounts for some other Elsevier services. See same subpage under the heading “Recognizing Reviewers.”

In short, peer reviewers are selected by the editor of a journal (in this case, Prof. Chen) either because the editor knows of their expertise, or because they have volunteered by signing up on the Reviewer Hub. They are not employees of or otherwise controlled by Elsevier. Plaintiff nowhere in its Complaint alleges otherwise, and having incorporated in its Complaint the web page discussed above, without criticism or challenge, plaintiff must be deemed to have accepted the truth and relevance of its contents.⁷

To sum up: the Article was written by people who were under no control by Elsevier, and subjected to an editorial process involving an editor and peer reviewers who were under no control by Elsevier. Whatever sins of commission or omission GPS may wish to lay at the feet any of these individuals, those sins cannot as a matter of law be attributed to Elsevier.⁸

In saying this, Elsevier is not simply taking shelter in a well-established legal doctrine. The whole point of the peer review process is to ensure that what gets published in a scholarly journal is vetted and approved by the scholarly peers of the authors. That is why it is “a central . . . quality-control feature in the scientific enterprise.” Consider what would happen if Elsevier were to be held liable for the aforesaid alleged sins. To protect itself in the future it could not rely on the decisions of the editors and peer reviewers of its journals. It would have to engage in a separate

⁷ In paragraph 49, the Complaint refers to the peer reviewers as “the peer reviewers at Elsevier.” This either willfully or carelessly ignores the information concerning peer review provided on the Elsevier web page that the Complaint itself cites. Nothing in the Complaint provides any basis for supposing that the peer reviewers were “at [i.e., employed by] Elsevier.” In fact, Elsevier’s peer reviewer information specifically states: “Please be aware that the choice of whether or not to choose a particular referee for a paper is entirely at the discretion of the editor and Elsevier plays no part in this decision.”

⁸ *Cantrell v. Forest City Pub. Co.* and the other cases cited above on the issue of vicarious liability all involve allegations of actual malice on the part of the writers concerned. As Elsevier will show in the penultimate section of this memorandum, “actual malice” is the applicable standard here as well. However, Elsevier could not be held liable even if the applicable standard were negligence. Negligence cannot be imputed to a non-employer any more than malice can.

review of every article published in any of its journals – a review for which it has no expertise. Worse, it would have to assert an explicit power to overrule the scientific decisions of the editors and peer reviewers of its journals – and so would every other publisher in the scholarly world. That by itself would undermine the integrity of the entire scholarly publishing process, and deprive science of the independent judgments of experts provided through the peer review process – a process that the Supreme Court has identified as critical to “good science.” This Court should not be abused for such a destructive purpose.

III. The Complaint Fails to Plead Facts that Would Make Elsevier Directly Liable.

Finally, one comes to the last remaining question of liability: what is Elsevier itself accused of?

The accusations in the Complaint against Elsevier are:

- That it circulated the Article “under the guise of academia.” Compl. ¶ 5.
This is a meaningless accusation from a legal standpoint. It is not even clear what GPS is trying to express here, beyond a sort of general contempt or irritation.
- That Elsevier “knew or should have known” that Brent Stephens, the IIT professor, had – *before the Article was even written* – consulted with IIT counsel about whether to name GPS in the Article, and “reached out” to a New York Times reporter about his research in “an attempt to gain publicity” and with the intent of “chasing fame and grant money from GPS’s competitors.” Compl. ¶ 6.

How Elsevier was supposed to know of these private, even privileged, conversations, GPS nowhere explains. Here, again, is a failure to allege any plausible fact that could be the basis of liability.

- That “the authors and Elsevier ignored contradictory data and discarded relevant test data,” as if Elsevier were involved in the writing process of the Article. Compl. ¶ 54.

Needless perhaps to point out, the Complaint never suggests when, where, or how such a thing could actually have taken place.⁹ The statement is simply careless failure to distinguish between the actors in this drama, of the sort that permeates the Complaint.

- That after the Article was published, upon receiving a demand letter from GPS’s counsel, Elsevier “failed to take corrective action,” i.e., to “meaningfully respond” to GPS or to retract the Article. Compl. ¶¶ 10-13.

Here again, GPS alleges no actionable conduct. As a matter of First Amendment law, a party claiming to have been defamed has no right to a retraction, for that would amount to compelling speech by the defendant. *Kramer v. Thompson*, 947 F.2d 666, 680-82 (3d Cir. 1991). Imposing liability for *failure* to retract would have the same serious First Amendment implications. See also *McFarlane v. Sheridan Square Press*, 91 F.3d 1501, 1515 (D. C. Cir. 1996) (“[Plaintiff] presents no authority, however, nor are we aware of any, for the proposition that a publisher may be liable for defamation because it fails to retract a statement upon which grave doubt is cast after publication.”).

- That Elsevier’s peer review process with respect to the Article was a “sham.”

This allegation of a “sham” seems to be the main thrust of the Complaint, as it is repeated several times. Compl. ¶¶ 2, 10, 14, and page 14 (heading C). It fails to meet the pleading requirements of *Iqbal* and *Twombly*, and the special pleading standards of F.R.C.P. 9(b).

⁹ Note that in paragraph 8, the Complaint alleges that one of the authors, Brent Stephens, “knowingly and selectively disregarded data,” but does not claim Elsevier was involved in that conduct.

The relevant meanings of the word “sham” are “a trick that deludes: [a] hoax,” and “an imitation or counterfeit purporting to be genuine.”¹⁰ To call something a “sham,” therefore, is to accuse its perpetrator of intentional fraud. But GPS nowhere alleges any facts that could support a finding that Elsevier’s peer review process was an intentional fraud. It is hard to imagine what sort of systemic misconduct Elsevier would have had to commit for its peer review process to be fraudulent, but in any case, GPS certainly alleges nothing to support such a claim. In fact, as noted above, GPS cites *without criticism* Elsevier’s own online description of its peer review process, which certainly undercuts any claim that the process was inherently a “sham.”

This failure to offer any facts, let alone connect them in a plausible narrative showing that Elsevier’s peer review process was fraudulent, falls far short of GPS’s pleading obligations. The allegations of a “sham” are nothing more than “naked assertions of wrongdoing” that do not permit this court to infer more than the “mere possibility of misconduct,” and thus fail to clear the hurdle articulated in *Francis v. Giacomelli, supra*, 588 F.3d at 193. GPS’s allegations also fail, *a fortiori*, the heightened standard of Fed. R. Civ. P. 9(b), which requires that in alleging fraud “a party must state with particularity the circumstances constituting fraud.”

Instead of pleading any actionable conduct by Elsevier, GPS asks the Court to infer such conduct from the outcome. It claims the peer review process was a “sham” because Elsevier “should have detected” the alleged flaws in the Article. Compl. ¶¶ 8, 49, 57-59. That, and nothing more, is what GPS’s Complaint really boils down to.¹¹ It is as if someone said: my roof caved in

¹⁰ <https://www.merriam-webster.com/dictionary/sham>.

¹¹ If there were any doubt on that score, a review of GPS’s own press release concerning this case would dispel it. (The relevant portion is attached as Exhibit B.) The press release is posted online at <https://www.businesswire.com/news/home/20220216005820/en/GPS-Pushes-Back-New-Filing>.

when the tree landed on it, so someone must have cheated me when they built the roof. That is not permissible pleading. The chain of causation is missing.

Even assuming for the sake of argument that GPS's grievances with the Article were valid, and the peer review process failed to detect them, the most one can permissibly infer from those premises is that the peer review process failed to work in this particular instance. The Complaint alleges no action by Elsevier that caused such alleged failure.

The fact of the matter is that the peer review process is not perfect – and no one claims it is. As the Supreme Court said in *Daubert*, while “[p]ublication (which is but one element of peer review) is not a *sine qua non* of admissibility; it does not necessarily correlate with reliability.” 509 U.S. at 593. The imperfections of the peer review process are a perennial subject of discussion in the scientific community. Perhaps the most succinct – and one of the best known – summaries of the matter was written back in 1989 by Dr. Arnold S. Relman and Dr. Marcia Angell, who at that time were the Editor and Assistant Editor of *The New England Journal of Medicine*, the nation's oldest and most prestigious medical journal. In an editorial entitled “How Good is Peer Review?”¹² they wrote:

[G]ood peer-reviewed scientific journals should provide their readers with reports of the best available research, free of obvious major flaws. Still, although peer review can screen out work that is clearly invalid and greatly improve the chances that published work is valid, it cannot guarantee scientific validity. Authors, editors, and reviewers are fallible, and no human enterprise is free of error. Authors may commit many forms of honest error, resulting from such things as observer bias, insensitive methods, failure to recognize and control for confounding variables, and just plain carelessness. These sorts of errors can easily be missed by reviewers and editors. In addition, concepts and methods are constantly changing and advancing, and new information can modify or refute even the most carefully reviewed published articles. Peer review may hold a manuscript to the highest standards, but error is inherent in research, and validity is

¹² N Engl J Med 1989; 321:827-829 (Sept. 21, 1989). A copy is attached as Exhibit C hereto. The quoted passage appears on page 828.

always conditional. In a sense, science advances by the continual discovery and correction of error.

Given this simple truth of fallibility, there is no basis for inferring any misconduct on the part of anyone involved in the peer review of the Article, let alone on the part of Elsevier. The Complaint not only fails to state a plausible case of misconduct, it fails even to show what *Iqbal* dismissed as the “mere possibility” of misconduct. *Ashcroft v. Iqbal*, *supra*, 556 U.S. at 679.

IV. The Article is Not Defamatory.

Given GPS’s failure to plead facts that would establish any liability on Elsevier’s part, it is theoretically beside the point whether the Article is in fact defamatory. But Elsevier wishes to address this question briefly, because the Article, properly read, is not defamatory.

The Complaint repeatedly asserts that the peer review process should have spotted all the flaws in the Article. Compl. ¶¶ 8, 49, 57-59. But if all the alleged flaws in the Article were so obvious, the Article could not be defamatory as a matter of law. A statement cannot be defamatory if it sets out the basis of the author’s assertions, so that readers can form their own opinions as to the meaning and validity of the statement. *Chapin v. Knight-Ridder, Inc.*, 993 F.2d 1087, 1093 (4th Cir. 1993); *see also Partington v. Bugliosi*, 56 F.3d 1147, 1156-57 (9th Cir. 1995) and cases cited therein. By “readers,” we are speaking here of scientists, not laymen, since the Article is written by scientists for scientists. *See Sprague v. American Bar Association*, 2001 U.S. Dist. LEXIS 18707, at *8-9 (E.D. Pa. Nov. 14, 2001) (an article in the *ABA Journal* should be read as lawyers would understand it).

The Article sets out in exhaustive detail exactly how the experiments it describes were conducted, and what the results were. One would expect GPS to identify one or more data sets or conclusions in the Article as false, and allege that the authors knew it to be false. But in fact the Complaint makes no such allegations. Rather, it tries to create the impression of inaccuracy,

mostly by criticizing certain methods used and choices made by the authors. Here is a list of its grievances, and why they are not defamatory:

1. The data in Appendices 1 and 2 (part of the “Supplementary data” published with the Article) contain values for “Ionizer On” and “Ionizer Off” that are the opposite of the data reported in the main body of the Article. Compl. ¶ 7; Doc 1-1 pp. 21-22; Doc 1-2 p.5. This is correct. However, that does not mean the Supplementary data are right and the data and conclusions in the text are wrong, as GPS seems to assume. The most that such a discrepancy establishes is that a mistake was made in one or the other. GPS does not suggest how it could be defamatory to publish supplementary data that directly contradict the conclusions contained in the text of the Article, let alone how seeming to undermine one’s own thesis is defamatory.¹³

2. The absence of a “counterfactual control.” Compl. ¶ 49. This absence was obvious on the face of the Article, and readers can form their own opinions as to whether it matters. The authors’ decision not to include a control was a matter of scientific judgment – and moreover, one that preceded the experiment – and cannot be considered defamatory.

3. The authors’ “[choice] to disregard the results from one of the test methods for the compound acetone (the TO-11A method) in favor of the other test method (TO-15) because of purported variation in the concentration of acetone outside of the chamber.” Compl. ¶ 49. GPS does not state that the TO-15 data were wrong, or that the authors had any reason to believe those data were wrong.

¹³ In fact, the authors have published a Corrigendum to the Article, explaining that the headings in the Supplementary data, of the tables referred to above, were mistakenly transposed, and that the data in the main Article are correct. See Exhibit D hereto. The URL is <https://www.sciencedirect.com/science/article/pii/S036013232200155X>.

4. The authors' choice to use their ethanol result based on a "flawed ratio calculation" of interior air to exterior air. Compl. ¶ 49. Here again, the authors' methodology was stated openly and readers could choose to find it persuasive or unpersuasive. Use of a "flawed ratio" is in any case not evidence of defamatory intent.

5. The authors' failure to repeat either of their experiments. Compl. ¶ 50. Failure to repeat an experiment may be a weakness, as the authors themselves acknowledged:

This work is not without limitations and future directions for improvement. For one, this work was limited to a small number of field and laboratory experiments of a single bipolar ionization device, without replicates.¹⁴

But failure to replicate is not defamatory. And the absence of replication was clear to any reader.

6. Failure to install the GPS machine in accordance with the manufacturer's instructions, thereby "tainting all their results, making it virtually impossible for others to reproduce or assess the data in any meaningful way or use it as a model for real-life conditions."

Compl. ¶ 51. This misrepresents the Article. The authors say:

The goal of this test setup was to deliver ions into the chamber space at an ion concentration that followed our understanding of manufacturer recommendations as closely as possible and at an air change rate with the surrounding environment that was . . . similar to that commonly observed in offices and other commercial buildings.

Doc 1-1, p.3. GPS does not explain how this statement is inaccurate or how what it describes is inappropriate. Furthermore, the "setup" is described in great detail, so that another scientist could indeed reproduce the experiment. None of this is evidence of defamatory intent.

7. Failure to "achieve a steady state" in the testing environment. Compl. ¶ 51. This too misrepresents what the Article says. In fact, the authors took pains to achieve "reasonably

¹⁴ Doc. 1-1, p. 13.

steady-state conditions,” as they describe repeatedly in the Article. Exhibit E to Elsevier’s motion shows the Article’s numerous careful references to the “steady state” issue.

In short, GPS’s attacks on the Article itself are (i) in some cases wrong, (ii) in other cases irrelevant as a legal matter, because the alleged flaws in methodology are fully disclosed for any reader to assess, and (iii) in all cases far short of what would be needed to show malice, or indeed even negligence, on the part of the authors.

V. Under the Principles of Libel Law, GPS is a Public Figure and Is Required to Plead Facts that Show “Actual Malice” by Defendants.

A public figure may seek redress for allegedly defamatory statements only if the defendant published the statements with “actual malice.” *New York Times v. Sullivan*, 376 U.S. 254, 279-280 (1964). That is the standard that applies here, and it makes GPS’s allegations against Elsevier – and indeed, against the Article – even more threadbare.

“Actual malice,” as the Fourth Circuit has explained, is a legal term of art; in the context of a defamation action “it does not mean ill will or intent to injure but rather that the defendant made the defamatory statement ‘with knowledge that it was false or with reckless disregard of whether it was false or not.’” *Fairfax v. CBS Corp.*, 2 F.4th 286, 292 (4th Cir. 2021) (citing *New York Times*, 376 U.S. at 279-280).

The Fourth Circuit has defined “reckless disregard” as “harboring a high degree of awareness of . . . probable falsity.” *Fairfax*, 2 F.4th at 293 (internal citations omitted). It “requires ‘much more than a failure to exercise ordinary care.’” *Hatfill v. New York Times Co.*, 532 F.3d 312, 325 (4th Cir. 2008) (quoting *Ryan v. Brooks*, 634 F.2d 726, 732 (4th Cir. 1980)). Recklessness “‘is not measured by whether a reasonably prudent man would have published, or would have investigated before publishing.’ . . . Rather, a plaintiff must prove that ‘the defendant in fact entertained serious doubts as to the truth of his publication.’” *Fairfax*, 2 F.4th at 293 (quoting *St.*

Amant v. Thompson, 390 U.S. 727, 731 (1968)). See also *Harte-Hanks Communications v. Connaughton*, 491 U.S. 657, 667 (1989).

As the Fourth Circuit explained in *Foretich v. Capital Cities/ABC*, 37 F.3d 1541 (4th Cir. 1994), the Supreme Court in *Gertz v. Robert Welch*, 418 U.S. 323 (1974), laid out the spectrum of defamation plaintiffs as follows:

At one end of the spectrum are ‘private individuals’ and at the other end are ‘public officials’ and ‘public figures,’ whom the Court divided into three categories: (1) ‘involuntary public figures,’ who become public figures through no purposeful action of their own; (2) ‘all-purpose public figures,’ who achieve such pervasive fame or notoriety that they become public figures for all purposes and in all contexts; and (3) ‘limited-purpose public figures,’ who voluntarily inject themselves into a particular public controversy and thereby become public figures for a limited range of issues.

Foretich, 37 F.3d at 1551-52 (quoting *Gertz*, 418 U.S. at 345, 351 (citations omitted)).

Plaintiff GPS boasts that it has “earned a reputation as a leader in the air quality/purification industry,” that its technology is “trusted by some of the world's leading companies involved in aviation manufacturing, aerospace technology, and performance equipment,” and that it has employees who are “prominent members in good standing of the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE)” and “regularly lead lectures and speak at ASHRAE meetings.” Complaint (“Compl.”), ¶¶ 32-34. These allegations, by themselves – particularly the last two – indicate that GPS has made a concerted effort to establish itself as a trustworthy authority on issues of air quality and air purification, and thus has made itself a limited purpose public figure on those broad issues.

In any event, it is clear that GPS is a limited purpose public figure with respect to the narrower issue of which the Article is a part: namely, the quality of its own technology. The “limited purpose public figure” inquiry, as the Fourth Circuit has explained, has two parts: (i) did a public controversy give rise to the allegedly defamatory statement, and if so, (ii) did the

plaintiff's participation in that controversy suffice to establish it as a public figure "within the context of that public controversy." *Carr v. Forbes, Inc.*, 259 F.3d 273, 278 (4th Cir. 2001).

To determine this, one must look at the public record. Elsevier is submitting herewith copies of various items posted on the Internet relative to this matter. These exhibits are offered solely to show that the question of air purification as a Covid-19 prevention technique was a matter of widespread public discussion and concern. "Courts may take judicial notice of publications introduced to 'indicate what was in the public realm at the time.'" *Von Saher v. Norton Simon Museum of Art at Pasadena*, 592 F.3d 954, 960 (9th Cir. 2010) (quoting *Premier Growth Fund v. Alliance Capital Mgmt.*, 435 F.3d 396, 401 n.15 (3d Cir. 2001)).¹⁵

As the Court will recall, when the Covid-19 pandemic struck the United States in early 2020, public officials and others scrambled to find out how it spread, and to find ways to prevent it from spreading. Indoor spaces were deemed the locations of greatest risk, which led to lockdowns in many parts of the country. On March 9, 2020, mere days after the first wave of Covid lockdowns started to ripple throughout the country, GPS issued a press release carried on Cision PRNewswire, entitled "Indoor Air Quality Technology Company, Global Plasma Solutions, Responds to Coronavirus."¹⁶ In this release GPS said:

While this epidemic moves closer to a pandemic, industries are wrestling with how to represent the effectiveness of their solutions in helping to control the spread of this outbreak; misinformation is soaring.

The statement went on to say that GPS had arranged for testing of its products "immediately" against a human coronavirus, and would "test COVID-19 upon availability."

¹⁵ While the Court may take judicial notice of these items *ex mero motu*, Elsevier intends to file a Motion for Judicial Notice in the near future, with respect to Exhibits F through Q.

¹⁶ See Exhibit F hereto. This appears at <https://www.prnewswire.com/news-releases/indoor-air-quality-technology-company-global-plasma-solutions-responds-to-coronavirus-301019802.html>

The issue of how to make buildings safe began to get attention in both the professional and the popular press. In the May 2020 issue of its publication the *ASHRAE Journal*, the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (“ASHRAE”) published an article entitled “Guidance for Building Operations during the COVID-19 Pandemic.”¹⁷ The ASHRAE article recommended certain changes to HVAC systems, including the adoption of “Merv-13” filtration, but did not recommend or even mention the “needlepoint bipolar ionization” technology that lies at the heart of GPS’s products. But GPS was not waiting for any official imprimatur, as may be seen in an article posted on May 12, 2020, on the Atlanta online news service Whatnowatlanta.com. The Whatnowatlanta article, entitled “Red Phone Booth Installs Air Purification, ‘Disinfection Technology’ In Anticipation of June 1 Reopening,” reported that Red Phone Booth, a local bar, had installed GPS equipment to attain the “gold standard” in air purification. This article indicates it was part of a series of articles on how Atlanta businesses were adapting to the coronavirus.¹⁸ It also quotes a GPS press.

Two weeks later, GPS and Brewers at 4001 Yancey, here in Charlotte, issued a joint press release, carried by PRNewsWire, announcing that the brewery had installed GPS equipment on its premises. The release was subtitled, “Mainstay of Charlotte Brewery Scene Partners with Global Plasma Solutions to Provide Clean Air, Safer Environment for Guests and Staff in Wake of COVID-19.” In the release, the CEO of the brewery said the installation had been made in

¹⁷ See Exhibit G hereto.

¹⁸ See Exhibit H hereto. This article appears at <https://whatnowatlanta.com/red-phone-booth-installs-air-purification-disinfection-technology-in-anticipation-of-june-1-reopening/>. Note: in this and certain other exhibits, photographs and other graphics have sometimes been cropped or eliminated in order to capture the full text in a static manner.

response to “over 7,000 responses” to a customer survey.¹⁹ Here again, GPS was injecting itself into the news – in the words of *Gertz*, thrusting itself “into the vortex” of this public issue – to tout its technology as a Covid solution. *Gertz, supra*, 418 U.S. at 352.

Soon after this, GPS went live with its most definitive claim. In a press release dated June 10, 2020, and carried by BusinessWire, GPS proclaimed:

Global Plasma Solutions Virtually Eliminates Static SARS-CoV-2 with Proprietary NPBI™ Technology.²⁰

And for another few months, positive news continued. *See, e.g.*, Exhibits K, L, M and N hereto:²¹

- “Pellston Public Schools to install air filter system in schools to help prevent COVID-19”
- “Greensboro Day School Invests in Global Plasma Solutions Air Purification System”
- “Vanbarton Group Installs First High-Rise Bipolar Ionization System in Seattle,” and
- “Bipolar Ionization Units installed in Gloucester Co. schools.”²²

¹⁹ See Exhibit I hereto. This release appears at <https://www.prnewswire.com/news-releases/brewers-at-4001-yancey-installing-bi-polar-ionization-system-to-improve-air-quality-and-eliminate-pathogens-in-its-space-301064608.html>.

²⁰ See Exhibit J. This item appears at <https://www.businesswire.com/news/home/20200610005784/en/Global-Plasma-Solutions-Virtually-Eliminates-Static-SARS-CoV-2-with-Proprietary-NPBI%E2%84%A2-Technology>.

²¹ These items are at, respectively:

<https://upnorthlive.com/news/local/pellston-public-schools-to-install-air-filter-system-in-schools-to-help-prevent-covid-19>,
https://www.yesweekly.com/business/greensboro-day-school-invests-in-global-plasma-solutions-air-purification-system/article_efe491d2-d8ca-11ea-ab18-1fe783e3d10c.html,
<https://www.businesswire.com/news/home/20201009005087/en/Vanbarton-Group-Installs-First-High-Rise-Bipolar-Ionization-System-in-Seattle>, and
<https://www.wtkr.com/news/bipolar-ionization-units-installed-in-gloucester-co-schools>. The last of these surveys the degree of adoption of various air filtration or purification systems in numerous Virginia school systems.

²² On October 27, 2020, at about the same time as the Seattle piece, *Education Week*, a major industry publication, carried an article discussing the pros and cons of air purifiers. See Exhibit O

By this time, GPS was beyond doubt a limited purpose public figure, by virtue of its extensive media campaign in a public health crisis. In *Steaks Unlimited v. Deaner*, 623 F.2d 264 (3d Cir. 1980), the Third Circuit faced a similar issue: whether the plaintiff, by “launching an intensive advertising campaign for the purpose of attracting customers,” had transformed itself into a limited purpose public figure. The Court held:

We have concluded that Steaks’ actions were calculated to draw public attention to the company and to stimulate consumer interest in its product. The company thereby voluntarily relinquished whatever protection it may have possessed as a purely private entity and is, in the context of this suit, properly characterized as a public figure within the meaning of *Gertz*.

* * *

Consumer reporting enables citizens to make better informed purchasing decisions. Regardless whether particular statements made by consumer reporters are precisely accurate, it is necessary to insulate them from the vicissitudes of ordinary civil litigation in order to foster the First Amendment goals mentioned above. As the Supreme Court recognized in *New York Times*, “would-be critics . . . may be deterred from voicing their criticism, even though it is believed to be true and even though it is in fact true, because of doubt whether it can be proved in court or fear of the expense having to do so.” To the extent this occurs, consumers would be less informed, less able to make effective use of their purchasing power, and generally less satisfied in their choice of goods.

Application of the public figure rule to sellers such as Steaks, which through advertising solicit the public’s attention and seek to influence consumer choice, therefore serves the values underlying the First Amendment by insulating consumer reporters and advocates from liability unless they have abused their positions by knowingly or recklessly publishing false information.

Id. at 280. The same principles apply here, but with greater urgency.

And as happened to the plaintiff in *Steaks*, GPS’ technology also became the subject of public debate. On January 22, 2021, the online news website MassLive published a story with the headline:

hereto. It made no mention of GPS’s technology, but it observed that ““schools are in desperate need of clear, definitive guidance for reopening buildings safely and maintaining in-person instruction over the long haul.” The URL is <https://www.edweek.org/leadership/air-purifiers-fans-and-filters-a-covid-19-explainer-for-schools/2020/10>.

Schools are spending millions on ionization technology to fight COVID and there's no good evidence it works.²³

MssLive quoted several scientists – none of them associated with the Article – expressing skepticism about the efficacy of the technology. Two days later, on January 24, 2021, a Pennsylvania news website called “The Morning Call” published a story about the Lehigh Valley school system’s installation of GPS air purifiers.²⁴ The story emphasized that GPS’s technology had not received any seal of approval for the use to which it was being put:

Still, the districts all faced a common challenge: Among the sea of products emerging during the pandemic that claim to sanitize and purify, which can be trusted?

Even the efficacy of bipolar ionization is still under review with a newly formed epidemic task force at the American Society of Heating, Refrigerating and Air-Conditioning Engineers — the industry experts who set standards for HVAC, among other systems.

‘Convincing, scientifically rigorous, peer-reviewed studies do not currently exist on this emerging technology; manufacturer data should be carefully considered,’ the organization states on its website.

The CDC, too, considers it an emerging technology because, though the process is old, its application to HVAC systems is new. In the past 20 years or so, bipolar ionization has mainly been marketed toward odor-elimination, such as in locker rooms or cosmetology labs.

‘As with all emerging technologies, consumers are encouraged to exercise caution and to do their homework,’ the CDC wrote in response to an ASHRAE inquiry.

In sum, as a result of all of GPS’s publicity, the value of GPS’s technology had become a full-blown public dispute by the time the Article underlying the Complaint was published – and GPS had become a limited purpose public figure. As such, GPS must meet the exacting standard of “actual malice” in its pleading. It must plead facts showing plausibly that Elsevier Ltd. published the Article with knowledge that it was false, or “harboring a high degree of awareness

²³ See Exhibit P hereto. The URL is <https://www.masslive.com/coronavirus/2021/01/schools-are-spending-millions-on-ionization-technology-to-fight-covid-and-theres-no-good-evidence-it-works.html>.

²⁴ See Exhibit Q hereto. The URL is <https://www.mcall.com/news/education/mc-nws-lehigh-valley-schools-bipolar-ionization-air-purification-20210119-r6tm6plr7ndctf5satiw3pujfi-story.html>.

of . . . probable falsity.” *Fairfax*, 2 F.4th at 292-293. Instead, all it has pleaded against Elsevier is that the peer review process resulting in publication of the Article “should have detected” the alleged flaws in the Article.

VI. GPS’s Claim of Unfair and Deceptive Trade Practices Fails, Both on its Own Merits and Also for the Same Reasons as its Defamation Claim.

North Carolina’s Unfair and Deceptive Trade Practices Act (UDTPA), N.C. Gen. Stat. § 75-1.1 *et seq.*, gives a business a cause of action against another business where “1) the plaintiff-business is in the marketplace acting as a consumer or is otherwise engaged in commercial dealing with defendant, 2) the businesses are competitors, or 3) the conduct giving rise to the cause of action has a negative effect on the consuming public.” *Exclaim Mktg., LLC v. DirecTV, LLC*, 134 F. Supp. 3d 1011, 1020 (E.D.N.C. 2015) (internal citations omitted), *aff’d*, 674 Fed. Appx. 250 (4th Cir. 2016). It is plain on the face of the Complaint that Elsevier and GPS are not engaged in any commercial dealings, and are not competitors. As for harm to the consuming public, GPS alleges none, nor is it conceivable that it could allege any, given that a practice is “unfair” within the meaning of the UDTPA only if it ““offends established public policy”” or is ““immoral, unethical, oppressive, unscrupulous, or substantially injurious to consumers.”” *McInerney v. Pinehurst Area Realty, Inc.*, 162 N.C. App. 285, 289, 590 S.E.2d 313, 316 (2004) (quoting *Marshall v. Miller*, 302 N.C. 539, 548, 276 S.E.2d 397, 403 (1981)). It is unimaginable that the mere publication of a scholarly article by a publisher could be characterized as any of those.

Furthermore, the rules governing GPS’s defamation claim must apply here, given that this case arises out of a media publication that is subject to First Amendment protection. GPS cannot make an end run around *New York Times* and *Gertz* by relabeling Elsevier’s publication of the Article as an “act or practice in commerce.” Courts have routinely denied similar end runs in comparable cases. *See, e.g., Aequitron Med. v. CBS, Inc.*, 964 F. Supp. 704, 710 (S.D.N.Y. 1997)

and cases cited therein (applying actual malice standard to media statements accused of “tortious interference”); *Granada Biosciences, Inc. v. Forbes, Inc.*, 49 S.W.3d 610, 618 (Tex. App. 2001) (applying the protections of *New York Times* to a media defendant in a product disparagement case).

Thus, the fact that Elsevier cannot be held liable for statements made by the authors of the Article means it cannot be held liable for those statements under the UDTPA.

CONCLUSION

GPS’s anger at the scientific publishing process comes across clearly in its Complaint, but the same cannot be said of any facts that would support its claims. GPS has failed to plead any basis on which Elsevier Inc. may be held liable for the Article in question. It has failed to plead that Elsevier Ltd., the publisher of the Article in question, had any control whatsoever over the contents of the Article. It has failed to plead any facts from which the trier of fact could find that Elsevier’s peer review process was a “sham.” Even its attacks on the Article itself misread the Article or ignore the context of what the authors say. Both its claim of defamation and its claim under the UDTPA fail to meet the standards of Rule 12(b)(6) and must be dismissed.

Respectfully submitted this the 15th day of April, 2022,

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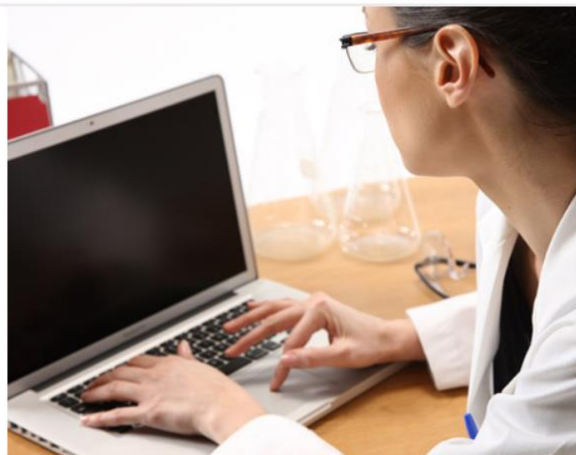
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GPS Pushes Back: New Filing Defends Company and NPBI Technology Against False and Defamatory Study



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February 16, 2022 10:28 AM Eastern Standard Time

CHARLOTTE, N.C.--([BUSINESS WIRE](#))--On January 26, 2022, Global Plasma Solutions ("GPS") filed a civil complaint for defamation and unfair and deceptive trade practices in the United States District Court for the Western District of North Carolina against Netherlands-based publishing company Elsevier for publishing and disseminating a false and misleading study involving GPS's Needlepoint Bipolar Ionization ("NPBI™") technology. The filing can be found [here](#). GPS filed the lawsuit after obtaining emails and deposing the lead author of the study which showed the full scope of the misrepresentations and flawed nature of the study.

The lawsuit lays out the following factual background: In March 2021, Elsevier published a study entitled, "Evaluating a commercially available in-duct bipolar ionization device for pollutant removal and potential byproduct formation," (the "Study") in the journal *Building and Environment*. The Study, authored under the direction of Illinois Institute of Technology professor Brent Stephens, was conducted with the predetermined outcome that GPS's technology was ineffective and increased certain compounds. Emails attached to the complaint show that the authors ignored contradictory data and misrepresented the results. The lead author of the Study has admitted under oath in a deposition taken in another lawsuit that the underlying data reported in the study was false and contradicted the conclusions reached by the authors. The study has been used to make false statements and incorrect conclusions about GPS's technology. The article's lead author also admitted under oath in early January 2022 that there was no experimental control to test the ionizer in on and off conditions in the reported field study. The emails attached to the complaint show that Stephens was pushing to get media attention for his predetermined conclusions well before the test was concluded.

Also, as laid out in the 32-page complaint:

- Data proving that GPS's NPBI technology performs as advertised was suppressed
- Test data was cherry picked while ignoring contradictory results.
- The authors did not repeat any of the experiments in the study. Experimental replication is an essential step of the scientific process to ensure that data, analysis and results are reliable.
- The authors failed to install and utilize the GPS device in a manner recommended by the manufacturer, thereby tainting all their results and making it virtually impossible to assess the data in any meaningful way.
- Elsevier's purported peer-review process was a sham as it failed to catch obvious flaws—in equipment, procedure and reporting. Each of these issues should have been caught in Elsevier's peer-reviewed process before the Article was released.

The Article has been weaponized by GPS's competitors to help create what they termed "bipolar backlash" to undermine GPS's technology. Despite being presented with this evidence, Elsevier has yet to retract the Study.

activin has been shown to stimulate the synthesis of hemoglobin in human bone marrow in vitro; inhibin inhibits this process.¹¹ Activin stimulates the secretion of oxytocin.¹² Inhibin and activin have been reported to alter the uptake of thymidine into thymocytes, suggesting a role in the mediation of the immune response.¹³

Gonadal secretion accounts for most, if not all, circulating inhibin, except during pregnancy, when the placenta is the source.⁸ Serum inhibin concentrations, measured by radioimmunoassay, become undetectable after castration in both sexes and after menopause, and they decline with aging in men. In women, inhibin comes from the granulosa cells and is therefore produced during the follicular phase of the menstrual cycle under the control of FSH. Serum inhibin levels rise during regimens of ovarian hyperstimulation, and the rise correlates with the number of ova produced for in vitro fertilization. Surprisingly, inhibin is also secreted during the luteal phase, when it is controlled by LH. In men, inhibin is produced by Sertoli cells under the control of FSH; however, LH also stimulates its secretion,¹⁴ either through an indirect effect on the Sertoli cells or through the production of inhibin by Leydig cells. Serum inhibin levels increase with gonadal maturation during puberty and also during the administration of gonadotropins to patients with a gonadotropin deficiency. These findings have led to the suggestion that the measurement of serum inhibin may be useful in assessing reproductive capability in a variety of clinical situations.

Lappöhn et al. expand on these possibilities by demonstrating that measurements of serum inhibin may serve as a useful marker of granulosa-cell tumor growth. These investigators found that, at least in some patients, serum inhibin levels increased months before any other manifestation of tumor recurrence could be detected. The increases in inhibin were found when levels of estradiol, the other proposed hormonal marker for these tumors, were very low. This finding has particular relevance when it is considered in relation to reports that chemotherapy with a combination of drugs can be very effective in such patients.

Serum inhibin measurements have also been suggested as a useful marker for another tumor, the hydatidiform mole.¹⁵ Inhibin levels were much higher in almost all patients with hydatidiform moles than in normal pregnant women. In some patients, inhibin was a more specific marker for such tumors than was human chorionic gonadotropin. After resection of molar tissue, inhibin levels fell rapidly (in less than 10 days) to the level found in the follicular phase before pregnancy if tissue removal was complete. In contrast, levels of human chorionic gonadotropin did not decrease to the nonpregnant level until approximately 10 weeks after the successful removal of a mole. Thus, inhibin appeared to be a better early indicator of the presence of residual molar tissue and therefore of the need for chemotherapy.

The story of developments pertaining to inhibin is

reminiscent of others in endocrinology. That is, a substance studied because of one biologic activity and one potential clinical application — in this case, FSH suppression and the potential for male contraception — turns out to have many other roles and potential applications, some totally unsuspected. The first clinical application of inhibin is likely to be as a serum marker for cancer. The administration of inhibin and related substances is also likely to be important in the control of human and animal reproduction. Together with the potential roles of inhibin in hematology, immunology, and local control of tissue growth, these are wide horizons for a humble gonadal product thought initially to have a relatively minor feedback influence on one pituitary hormone.

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HOW GOOD IS PEER REVIEW?

RECENT concern about the validity and honesty of biomedical research — especially that large fraction of research supported by public funds — has led to demands for greater accountability on the part of the research community. Since most scientific research is published only after evaluation by editors of scientific

journals and their advisers — a process known as peer review — it is not surprising that this process, too, has come under critical examination. Peer review now stands to receive the same scrutiny as the work being reviewed. Particularly in view of recent cases in which fraudulent reports appeared in reputable journals after undergoing peer review, questions are being raised about the value of the review process as well as its reliability and objectivity.

Such questions were aired in October 1988 at a conference held by the Council of Biology Editors in Washington, D.C., and again last May in Chicago at the First International Congress on Peer Review, sponsored by the American Medical Association. From comments made at these meetings and the press coverage that followed, it became clear that many observers believe the process of peer review should be more open and accountable, and some also think it should be made more objective or quantitative.¹⁻⁴ Peer review also came under criticism at these meetings for not more effectively ensuring the validity and honesty of published work.

How much substance is there to these concerns and criticisms? The answer to that question requires more knowledge of the peer-review process than is generally available.⁵ Not only those outside the scientific establishment, but also many researchers and reviewers involved in peer review have widely different perceptions of its functions and methods. Even editors who oversee the process differ in their views of how it should work and what its purposes should be. Furthermore, because peer review has traditionally been regarded as a confidential transaction, it has received little outside attention and even less systematic study.

To understand the value as well as the limitations of peer review, one must first have an accurate picture of the way it is usually carried out. In the article that appears elsewhere in this issue, we briefly describe the *Journal's* peer-review policies and practices.⁶ They differ in some details from those of other medical journals, particularly the smaller specialty journals, but the basic principles are generally the same.

As should be clear from this description, peer review is not and cannot be an objective scientific process, nor can it be relied on to guarantee the validity or honesty of scientific research, despite much uninformed opinion to the contrary. Its functions are more modest, but nonetheless valuable. From the often large numbers of manuscripts submitted to them, editors of peer-reviewed journals must select those that are most important and interesting to their particular readers. They must also see that the work they select is as sound as possible and that it meets the best current scientific standards. To make these judgments, editors need the assistance of experts in the field, whose criticisms and suggestions also help the authors revise and improve their work. Authors may even be required to do more research, as well as to revise their analysis, interpretation, or presentation. As a result, the pub-

lished version of the paper is more likely to be sound and readable than the version initially submitted for review. Furthermore, peer review discourages the publication of trivial or redundant work.

Thus, good peer-reviewed scientific journals should provide their readers with reports of the best available research, free of obvious major flaws. Still, although peer review can screen out work that is clearly invalid and greatly improve the chances that published work is valid, it cannot guarantee scientific validity. Authors, editors, and reviewers are fallible, and no human enterprise is free of error. Authors may commit many forms of honest error, resulting from such things as observer bias, insensitive methods, failure to recognize and control for confounding variables, and just plain carelessness. These sorts of errors can easily be missed by reviewers and editors. In addition, concepts and methods are constantly changing and advancing, and new information can modify or refute even the most carefully reviewed published articles. Peer review may hold a manuscript to the highest standards, but error is inherent in research, and validity is always conditional.⁷ In a sense, science advances by the continual discovery and correction of error.

If peer review cannot guarantee the validity of research, still less can it be relied on to detect fraud.⁸ Reviewers and editors have no choice but to trust authors' descriptions of their methods and results. They may question the importance and novelty of a study, the adequacy of the design and methods, and the logic of the analysis, interpretation, and conclusions. They must, however, rely on the authors' account of what they did and what they found. Reviewers cannot, after all, watch the experiments being performed. Even if the data were entirely fabricated, reviewers and editors might not discern the fraud if the data were plausible and internally consistent. In general, fabrication must be careless or clumsy to be picked up in the peer-review process. Demands that journals detect and screen out dishonest science are therefore misplaced. The honest conduct of research is best ensured by coworkers and supervisors and by the institutions where the work is done, which can do much to foster the proper environment and incentives.^{9,10}

Do the limitations of peer review mean it is worthless? Not at all. Peer review is necessary to evaluate and improve the quality of research, raise standards generally, and help direct manuscripts to the most appropriate journals. In our view, many of the defects of peer review are the result of inadequate editorial supervision of the process, often stemming from a faulty understanding of the responsibilities of reviewers and editors. It is important that reviewers serve as consultants to editors, not as decision makers. In the natural course of things, the reviewers who are best equipped to evaluate a study are also likely to be competitors of the authors. Authors can be protected from any bias inherent in this situation if editors are careful to evaluate reviews for their persuasiveness, are ready to ignore an unreasonable or unfair review, and give

authors a chance to respond to criticism. It has been suggested that the supposed biases and tyranny of reviewers might be curbed if they were required to sign their reviews and were blinded to the identity of authors. Although it may be useful to investigate these suggestions, we suspect that the best guarantee of an unbiased review system is a fair and conscientious editor who is willing to take responsibility for decisions about publishing manuscripts and who remains open to rebuttals and appeals from authors.

Peer review by scientific journals is but one essential part of the complex enterprise of scientific research, and it is important to understand what it can and cannot do. Whether it can ever become the kind of objective process some would wish or whether its methods can ever be verified in the way its critics demand is dubious. Peer review concerns itself with quality, which is easier to recognize than measure. Although the subjectivity of the peer-review process may trouble some of its critics, when properly used it is a powerful means of protecting and improving the quality of what is published. Peer review has its limitations, but it is hard to imagine how we could get along without it.

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students, professionals, and "internationalistic activists" in residence since the mid-1960s can have an AIDS rate that compares with that of the American Bible Belt is indeed rather perplexing.

Cuba officially recognized the presence of human immunodeficiency virus (HIV) infection on the island in April 1987.¹ Yet, HIV infection was prevalent in Cuba in 1980, as shown by a serologic study of newly arrived immigrants.² In fact, contrary to what Dr. [Hector] Terry [Cuba's vice-minister of health] and Castro would have the world believe, the extent of the HIV epidemic in Cuba is more like that in New York City than that in Oklahoma.^{2,3} A study in a representative sample of immigrants with rates of diabetes, hypertension, and hepatitis B comparable to those reported by Cuba and easily verified by Cuban official data showed that Cuba's rate of HIV seropositivity in 1980 may have been the highest in the Americas.⁴⁻⁷ In fact, judging from testimony given by physicians who have escaped from Cuba, the first obvious cases of *la enfermedad del virus* were seen in the late 1970s in community hospitals.

Many disturbing issues are raised by Cuba's approach to AIDS, but the fact that lifelong isolation of the sick is based on a micro-ELISA (enzyme-linked immunosorbent assay) that was developed in Cuba, and to our knowledge has never been validated elsewhere, seems to be a point worthy of interest, debate, and study. AIDS is not only a health problem in Cuba, it is an overwhelming political problem, since the entire AIDS campaign is under the direction of State Security (the Cuban KGB), not the Ministry of Health.

The confinement approach might have had some realistic control value if it had been enacted in Cuba in the early 1970s. Obviously, not even Cuban health officials knew then that a pandemic was to develop. The discrepancies between the official Cuban reports, what is shown to invited guests and visitors, and what can be verified from this country suggest that the Cuban health care network has turned into a bizarre facade, behind which strategic and propaganda issues overrule public health matters.

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CORRESPONDENCE

CONTROLLING AIDS IN CUBA

To the Editor: The Special Report by Bayer and Heaton (April 13 issue)¹ on the acquired immunodeficiency syndrome (AIDS) in Cuba raises questions that should be considered in the light of the available information. Indeed, Cuba's approach to AIDS control is unique. It does not emphasize education, it has screened about 4 million persons and plans to screen the entire population of the island, and it has reported a seropositive rate that is comparable to that of Oklahoma. How a Caribbean island with a 500 percent increase in gonorrhea in the past 10 years,² a contingent of 380,000 in Africa since 1975, and more than a quarter of a million African

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Corrigendum to “Evaluating a commercially available in-duct bipolar ionization device for pollutant removal and potential byproduct formation”[Build. Environ, Volume 195, May 2021, 107750]

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The authors wish to make one correction and one clarification to the paper.

First, the “Ionizer Off” and “Ionizer On” headers for the two tables in the supplementary data were accidentally transposed. “Ionizer On” should read “Ionizer Off” and “Ionizer Off” should read “Ionizer On” in Appendices 1 and 2. The mislabeling does not affect any other figures, tables, or results. Furthermore, the data reported and used throughout

the main text are accurately identified and labeled. The authors regret any confusion that the mislabeling of the appendices may have created.

Second, by way of clarification: the reason that this study analyzed the acetone concentration data from the TO-15 analyte list rather than the TO-11A list is that TO-15 is a more precise and accurate method for the compound with the instruments used.

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Evaluating a commercially available in-duct bipolar ionization device for pollutant removal and potential byproduct formation

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ABSTRACT

We conducted a series of experiments to evaluate the gas and particle removal effectiveness and potential for byproduct formation resulting from the operation of a commercially available in-duct bipolar ionization device. Laboratory tests were conducted with the ionizer installed in a small air handler serving a large semi-furnished chamber. Chamber experiments were conducted under (i) normal operating conditions to characterize the impact of the ionizer on concentrations of particles (0.01–10 µm), ozone (O₃), nitrogen dioxide (NO₂), volatile organic compounds (VOCs), and aldehydes, and (ii) particle injection and decay conditions to characterize the impact of the ionizer operation on particle loss rates. The field test involved air sampling of particulates (0.01–10 µm), O₃, and VOCs upstream and downstream of an operating ionizer device installed in an air handling unit serving an occupied office building. Both the chamber and field tests suggested that the use of the tested bipolar ionization unit led to a decrease in some hydrocarbons (e.g., xylenes) among the lists of compounds we were able to analyze, but an increase in others, most prominently oxygenated VOCs (e.g., acetone, ethanol) and toluene. Ionizer operation appeared to minimally impact particle, O₃, and NO₂ concentrations during normal operating conditions. Particle injection and decay experiments in the chamber suggest that operation of the ionizer unit led to a small increase in loss rates for ultrafine particles (<0.15 µm) and a small decrease in loss rates for larger particles (>0.3 µm), but with negligible net changes in estimated PM_{2.5} loss rates.

1. Introduction

As a result of recent global air quality challenges, including smoke from historically large wildfires in the U.S [1] and the increasing recognition of the potential for aerosol transmission of COVID-19 in poorly ventilated indoor environments [2], there has been an unprecedented level of interest and investment in indoor air cleaning technologies. The marketplace for air cleaning devices has become inundated with an array of technologies to meet the demand, including high-efficiency fibrous-media filters, disinfectant misters, and a variety of electronic air cleaners including ultraviolet germicidal irradiation (UVGI) lights, plasma generators, hydroxyl radical generators, ionizers, and more [3,4,5,6,7]. While fibrous media filters are routinely tested for their ability to remove particles [8,9], many electronic air cleaning

technologies are not evaluated by any federal agency or industry standards organizations for their efficacy or their potential for unintended consequences, including the generation of chemical byproducts [10].

One such air cleaning technology that has garnered significant interest is air ionization, which involves the introduction of ions to a space. Air ionization devices include those that generate only negative ions (i.e., *unipolar* ionizers) and those that generate both positive and negative ions (i.e., *bipolar* ionizers). Air ionization has been shown in some peer-reviewed studies to decrease bacterial deposition to surfaces [11], inactivate airborne bacteria [12,13], remove airborne particles [14], and increase submicron particle deposition to surfaces [15]. While the efficacy for some of these constituents has been demonstrated in some peer-reviewed studies, the literature remains sparse and limited to a narrow range of technologies.

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More commonly, efficacy is demonstrated in test reports provided by commercial laboratories, although these tests commonly have limitations such as multiple ionizers in small (or unreported) volume test chambers or with high (or unreported) ion concentrations. Moreover, the potential for byproduct formation resulting from ionizer operation has been investigated in much less depth. Early tests on ionizer devices revealed the potential to form harmful byproducts such as ozone during operation [16], but manufacturers have since developed other forms of ionization technologies that have been shown to avoid ozone emissions [13]. However, a limited number of other studies have shown the potential for ionization to form other products, including nitrogen oxides (NO_x) and VOC oxidation intermediates [17], although little peer-reviewed literature exists on byproduct formation in either laboratory or field settings.

Two recent studies evaluated the impacts of air ionization on markers of human health. One study investigated the short-term effects of a negative ion generating air purifier on cardiovascular and respiratory outcomes in healthy adults in Beijing [18]. The study concluded that exposure to negative ions ($\sim 60,000$ ions/ cm^3) was associated with increased systemic oxidative stress levels (a biomarker of cardiovascular health), and even though the use of the ionizers decreased indoor particulate matter concentrations, there were no beneficial changes in other markers of respiratory health. This phenomenon was hypothesized to be due to byproducts formed from reactions with negative ions, although byproducts were not measured. Another recent study found similar outcomes in 11–14 year old children resulting from the use of air ionizers in school classrooms in Beijing, whereby some positive effects on respiratory health were measured at elevated ion concentrations of $\sim 13,000$ #/ cm^3 , albeit at the expense of negative effects on cardiac health [19]. These studies demonstrate the potential for air ionization to be effective in reducing particulate matter, but also suggest the potential for ionization to generate potentially harmful byproducts during their operation.

One of the most widely used ionization approaches currently in the U.S. appears to be *bipolar ionization*, which is commonly reported to (i) reduce airborne particulate matter by causing them to cluster or agglomerate and form larger particles that can settle out of the air more rapidly or be filtered more effectively, (ii) neutralize odors and break down volatile organic compounds (VOCs), (iii) inactivate or kill viruses and other microorganisms, and (iv) reduce the amount of required outdoor air. Many engineers have been recommending bipolar ionization devices because of relatively low upfront costs for purchase and installation, low maintenance and materials costs, and they do not introduce additional pressure drop to air handling units. In fact, the Building Owners and Managers Association (BOMA) currently recommends to “explore the possible use and efficacy of bipolar ionization and other technology for the HVAC system that are effective against COVID” [20].

Conversely, ASHRAE summarizes the literature on electronic air cleaners, including ionizers, in their Epidemic Task Force (ETF) Filtration and Disinfection Guidance, as well as in their most recent position document on filtration and air cleaning, as ranging from “ineffective” to “very effective” in reducing airborne particle concentrations [21,22]. ASHRAE’s COVID-19 resources also cite a statement from a representative from the US Centers for Disease Control and Prevention (CDC) that recommends consumers “request efficacy performance data that quantitatively demonstrates a clear protective benefit under conditions consistent with those for which the consumer is intending to apply the technology” and that “the documented performance data under as-used conditions should be available from multiple sources, some of which should be independent, third party sources.” Recent guidance from the CDC considers ionization and other air disinfection technologies as “emerging” technologies “in the absence of an established body of peer reviewed evidence showing proven efficacy and safety under as used conditions” [23]. We are not aware of investigations of the effectiveness or potential for byproduct formation of bipolar ionization

devices used in realistic settings, which presents a knowledge gap that this work intends to fill.

2. Methods

We conducted a series of experiments to evaluate the gas and particle removal effectiveness and potential for byproduct formation resulting from the operation of a commercially available bipolar ionization device in two different test settings: one laboratory (large chamber) setting in Chicago, IL, USA and one field setting in a city in Eastern Oregon (OR) USA. The same make and model ‘needlepoint’ bipolar ionization device (Global Plasma Solutions, GPS-FC48-AC, Charlotte, NC USA) was tested in each location. We did not assess efficacy in inactivating microbes or potential pathogens.

2.1. Laboratory (large chamber) experiments (Chicago, IL)

Because ions added to indoor environments can react with other compounds present in indoor air, potentially leading to the formation of intermediates and oxidation byproducts, we conducted a series of experiments in a large (36.7 m^3) aluminum environmental chamber recently constructed on the main campus of Illinois Institute of Technology in Chicago, IL USA (Fig. 1). The chamber is located in a large laboratory space and was not directly heated or cooled, but was served by a small custom-built air-handling unit supplying air from the surrounding conditioned laboratory space. Laboratory air was pulled through a charcoal fiber filter (Hydrofarm IGSCFF4, Petaluma, CA USA) on the return side and ducted into the chamber via a flexible aluminum duct. The air handler and ductwork were operated in a single pass-through mode to provide approximately $40\text{--}120 \text{ m}^3/\text{h}$, depending on the fan speed setting, of filtered air from outside the chamber into the chamber without any recirculation. The surrounding laboratory space was minimally occupied by researchers during testing.

A variety of (mostly aged) material emission sources were introduced into the chamber prior to testing to simulate a partially furnished office or similar environment with a variety of relatively constant VOC emission sources that introduce a ‘challenge’ indoor VOC mixture with which ions generated by the tested ionizer would conceivably interact. Materials introduced to the chamber included a used table, rug, plastic and metal chairs, suit jackets, a scarf, window shades, paper posters, foam packaging materials, multiple boxes of dissertations ranging in publication date from the 1960s–1990s, a used painting tray, and more. Several dissertations were also left open on the table to encourage emissions. **Transient VOC emission sources were specifically avoided in order to ensure reasonably steady-state conditions could be achieved.** A small fan was placed in the corner of the chamber to encourage mixing throughout testing. A CO_2 injection and decay test with three CO_2 monitors (calibrated via co-location tests) located in three different locations within the chamber confirmed reasonably well-mixed conditions (Fig. S1).

A single GPS-FC48-AC bipolar ionization unit was installed inside the small air-handling unit serving the chamber, positioned upstream of the fan in a small custom-fabricated return plenum. The ionizer was secured to the bottom surface of the return plenum and connected to a 120 VAC power source. The on/off switch for the device extended to the outside of the air handler to allow for powering on the ionizer without disrupting airflow conditions. The manufacturer data sheet for the GPS-FC48-AC unit states that it is designed to accommodate airflows from 0 to $4000 \text{ ft}^3/\text{min}$ ($\sim 0.155 \text{ m}^3/\text{s}$) and generates >400 million ions/cc/sec [24].

The goal of this test setup was to deliver ions into the chamber space at an ion concentration that followed our understanding of manufacturer recommendations as closely as possible and at an air change rate with the surrounding environment that was (i) similar to that commonly observed in offices and other commercial buildings (e.g., 1–1.5 per hour [25,26]) and that also (ii) allowed for reasonably rapid approaches to

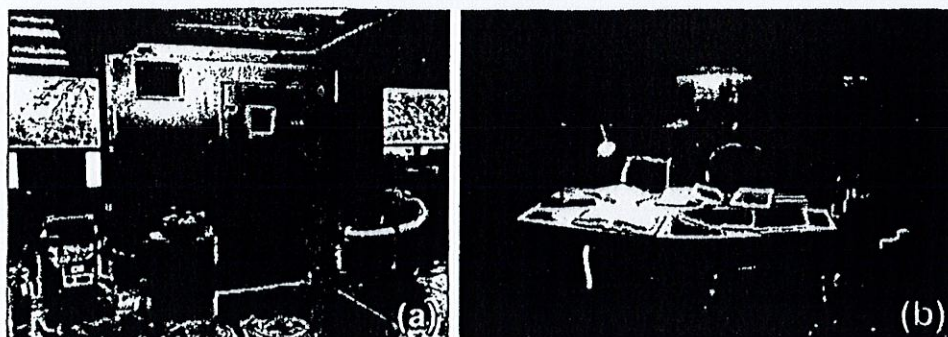


Fig. 1. Photos of the environmental test chamber: (a) exterior with instruments set up outside and (b) inside of the chamber with mock-up furnishings and materials.

steady-state conditions for air sampling and for comparisons of pollutant concentrations between ionizer off and on conditions. Air change rates with the surrounding lab air were measured periodically inside the chamber using CO₂ injection and decay to ensure these conditions were met. Repeated CO₂ injection and decay experiments before and after testing confirmed a typical chamber air change rate with air from the surrounding lab area of ~1.2–1.6 per hour (1/h). The system was a single pass system without recirculation.

Initial measurements of total volatile organic compound (TVOC) concentrations inside and outside the chamber, both before and after introducing furnishing and materials, were made using a ppbRAE 3000 photoionization detector (PID) monitor (RAE Systems, San Jose, CA USA), which confirmed that the introduction of furnishings and materials led to an increase in TVOC concentrations (reported as isobutylene equivalents) inside the chamber compared to background conditions and that approximately steady state conditions could be reached within ~2–3 h (Fig. S2). Additionally, measurements of ion concentrations were made periodically inside and outside the chamber, both with and without the ionizer operating, using an AlphaLab Air Ion Counter (Cerdien Tube meter) prior to testing (AlphaLab, Inc., Salt Lake City, UT USA). Background ion concentrations inside the laboratory (outside the chamber) and inside the chamber typically ranged between 300 and ~700 ions/cm³. Operation of the ionizer increased ion concentrations inside the chamber to steady-state concentrations of ~1400–2000 ions/cm³, which is consistent with the manufacturer recommended target of 1500–2000 ions/cm³ in spaces in which they are installed [27], albeit lower than ~13,000 ions/cm³ and ~60,000 ions/cm³ reported in the recent studies of short-term health outcomes associated with using a different type of ionizer as previously mentioned [11,21] and much lower than the high concentrations (i.e., >10⁶ ions/cm³) that have been associated with lower depression scores [28]. While this installation and setup is not the same as a real-life installation in an occupied building, the resulting combination of ion concentrations, ventilation conditions, and, to an extent, indoor VOC concentrations, reasonably represent conditions of a realistic unoccupied indoor space with this ionization unit installed in the air handler serving the space.

Once the chamber, air handler, and ionizer were set up, a series of experiments were conducted over multiple test days to evaluate the gas and particle removal effectiveness and potential for byproduct formation resulting from ionizer operation. The experimental design was intended to capture the effects of ionizer operation under (i) normal operating conditions and (ii) particle injection and decay conditions.

2.1.1. Normal operating conditions

First, a series of experiments were conducted under normal operating conditions (i.e., without any particle or pollutant injection other than from the supplied laboratory air and the materials and furnishings inside the chamber) to measure a variety of constituents inside and outside the chamber with the air handler operating, once with the ionizer powered on and once with the ionizer powered off. We repeated the same normal

condition experiments on multiple days under similar conditions, once on October 15, 2020 to primarily focus on measurements of VOCs inside and outside of the chamber (which required sampling and offline analysis at a commercial laboratory), followed by another test day on October 24, 2020 to focus on measurements of particles, ozone, and nitrogen oxides inside and outside of the chamber.

During these experiments, we measured the following constituents inside and/or outside the chamber: (i) airborne particles using a TSI Model 3910 NanoScan Scanning Mobility Particle Sizer (SMPS; ~0.01–0.4 µm; TSI Shoreview, MN USA) and a TSI Model 3330 Optical Particle Sizer (OPS; 0.3–10 µm), (ii) ozone (O₃) using a 2B Technologies Model 211 ozone analyzer (2B Technologies, Boulder, CO USA), (iii) nitrogen oxides (NO_x) using a 2B Technologies Model 405 NO_x analyzer, and (iv) CO₂ using Extech SD800 CO₂ monitors located inside and outside the chamber (Extech, Nashua, NH USA). After the October 15, 2020 test day, the particulate matter (PM) and NO_x sampling instruments were each connected to automated switching valves (Swagelok Model SS-43G/G4-42DCX electrically actuated three-way ball valves; one each for PM and NO_x; Swagelok, Solon, OH USA) to alternately measure concentrations inside and outside the chamber at 20-min intervals throughout the duration of testing [29,30,31]. The switching valve was controlled automatically by an electronic timer (Sestos B3S-2R-24; Hong Kong). The O₃ instrument was not connected to a switching valve.

On the October 15, 2020 sampling day conducted to characterize gas-phase organics, we sampled for (i) VOCs using SUMMA canisters (Entech 1.4L Silonite Coated stainless steel Minicans with a flow restrictor providing approximately 30 min fill duration), with off-line analysis conducted via EPA method TO-15 as well as a NIST library compound search to tentatively identify compounds not on the TO-15 list, and (ii) aldehydes and carbonyls following EPA method TO-11A using 2,4-Dinitrophenylhydrazine (DNPH) sampling tubes connected to sampling pumps (Buck Libra Model L-4) with off-line analysis conducted via high-performance liquid chromatography (HPLC). Off-line chemical analysis was conducted at a commercial laboratory (STAT Analysis, Chicago, IL), as described in more detail later in this section. Sampling pump flow rates for TO-11A sampling were confirmed after sampling to be ~1.6–1.7 L/min prior to sampling using a Sensidyne Gilian Gilibrator-2 bubble flow meter (Sensidyne, St. Petersburg, FL USA). Time-integrated VOC and aldehyde samples were collected using the SUMMA canisters and DNPH tubes, respectively, beginning at least 2 h after perturbation of the chamber (i.e., both before and after the ionizer was switched on) such that the chamber should have approached steady-state conditions by the time of sampling. All sampling devices (except for one CO₂ monitor) were located outside the chamber with sampling lines running into the chamber through openings approximately 0.36 m off the floor, which were sealed with cardboard and tape. Particle instruments were connected to rigid stainless steel sampling lines ~1.5 m in length and ~0.5 cm in diameter via TSI conductive tubing; O₃, NO_x, and SUMMA canisters were connected to flexible

polytetrafluoroethylene (PTFE) tubing for sampling. Temperature and relative humidity were measured continuously both inside and outside the chamber using a combination of Onset HOBO U12-012 (Onset, Bourne, MA USA) and Extech SD800 CO₂ monitors.

The timeline of the normal operating condition experiments on the single VOC sampling day (October 15, 2020) is shown in Fig. 2. The air handling unit serving the chamber was turned on around 9:45 a.m. local time, with the ionizer off for the first several hours of measurements. The chamber operated at this condition for nearly 3 h to allow for approaching steady-state baseline conditions inside the chamber. VOCs were then sampled inside and outside the chamber during these baseline (ionizer off) conditions beginning around 12:30 p.m. The SUMMA canister valves were opened for approximately 30 min and the DNPH samplers were operated from about 12:30 p.m. to 2:57 p.m. for inside sampling and 1:10 p.m. to 2:57 p.m. for outside sampling. After VOC sampling with the ionizer off was completed, the ionizer was turned on at 3:16 p.m. The ionizer remained on for the duration of the rest of the tests. After approximately 2 h of operating the system, around 5:16 p.m., we again began sampling for VOCs and aldehydes inside and outside the chamber using new SUMMA canisters and DNPH tubes, respectively. Again, the SUMMA canister valves were opened for approximately 30 min and the DNPH personal air sampling pumps were operated with new DNPH tubes from ~5:16 p.m. until ~7:45 p.m. A blank DNPH tube was placed outside the chamber throughout testing to serve as our blank control sample. Finally, CO₂ injection and decay was conducted around 7:45 p.m. to measure the air change rate in the chamber.

After sampling, the DNPH cartridges and field blanks were individually capped and wrapped in aluminum foil and kept in a refrigerator held at ~4 °C. The following day, a total of five DNPH tubes (placed in a thermally insulated box) and four SUMMA canisters were returned to a commercial laboratory for chemical analysis (STAT Analysis, Chicago, IL), including two inside chamber samples (one with ionizer off; one with ionizer on); two outside chamber samples (one with ionizer off; one with ionizer on); and one blank. STAT Analysis originally supplied the evacuated SUMMA canisters for VOC sampling and DNPH cartridges for aldehyde sampling. The SUMMA canisters were analyzed via a purge and trap volatile autosampler on an Agilent 6890 gas chromatograph (GC) with an Agilent 5973 mass selective detector (MS). This results in a chromatogram that shows mass spectral data for any detected compound as well as retention time. The commercial laboratory has a calibrated list of compounds that it can quantitate against. The MS also allowed for an assessment of tentatively identified compounds (TICs), which have peaks and spectrum show up in the chromatogram, but are not a part of the calibrated list. These TICs were reported from comparing the MS data to a known NIST library of compounds; library compound search reports were provided by the lab for subsequent analysis. DNPH cartridges were also acquired from the same commercial laboratory and returned for analysis, which involved extraction in solvent and analysis on an Agilent 1100 HPLC system against a list of known compounds from the TO-11A list. Concentrations from DNPH sampling were calculated by dividing mass values provided by STAT Analysis by the volume of the sample (calculated as the pump flow rate times the sample time). STAT Analysis calibrates their analytical systems to the list of compounds in TO-15 and TO-11A; the TICs allow for some

semi-quantitative assessment of additional TICs not in these lists. Full lists of compounds from the TO-15 and TO-11A analysis are provided in Appendix 1 and Appendix 2. Method blanks were included with each run and verified that target compounds were below reporting limits (RL).

On the October 24, 2020 sampling day, which was designed to characterize impacts on particles, O₃, and NO_x during normal operating conditions, all instruments were set to log data at 1-min intervals. To analyze the resulting measurements of particulate matter and NO_x concentrations from the instruments connected to automated switching valves, we noted the time that initial sampling began with the automated valves sampling from inside the chamber, and then flagged the data points in each 20-min sampling interval as either inside or outside the chamber in alternating fashion. Transition points between inside and outside sampling periods were identified visually in the data and excluded from analysis. Ratios of the concentrations of constituents inside and outside of the chamber (i.e., I/O ratios) were calculated using summary statistics (mean, standard deviation) from each 20-min interval of inside chamber sampling, lagged by the previous 20-min interval of outside chamber sampling.

2.1.2. Particle injection and decay

After conducting experiments during normal operating conditions, a series of particle injection and decay experiments were conducted to explore the impact of ionizer operation on particle decay rates in the chamber. These experiments were conducted on two separate days: one day with the ionizer operating (October 31, 2020) and one day without the ionizer operating (November 8, 2020). The chamber was maintained at approximately the same airflow and environmental conditions for both days of testing, which were also similar to the normal operating condition experiments. Particles were generated by burning two sticks of incense placed on a shelf on the desk inside of the chamber. Incense sticks were allowed to burn to completion to avoid researcher entry into the chamber, extinguishing after approximately 30 min, and then particle concentrations were allowed to decay for 2–4 h under each test condition.

Measurements of particle concentrations during these experiments were made again using a TSI NanoScan SMPS and TSI OPS to measure particle number concentrations in size ranges from ~0.01 µm to ~10 µm at 1-min intervals, again connected to the sampling system with an electronically controlled automated switching valve, alternating between 20-min periods sampling inside the chamber and 20-min periods sampling outside the chamber. CO₂ was also injected into the chamber at the same time as incense burning to simultaneously measure the air change rate with the surrounding lab.

2.1.3. Data analysis and parameter estimation

Particle injection and decay data were first visually explored on a size-resolved basis (up to 13 bins for SMPS and up to 16 bins for OPS). For simplicity in making comparisons, integral measures total particle number concentrations measured by each instrument were used in the analysis. The Nanoscan SMPS has known issues with counting efficiencies, especially in size ranges >0.15 µm, during some conditions due to the method used to fit distributions required because of the use of a unipolar charger in the instrument [32,30]. Total number

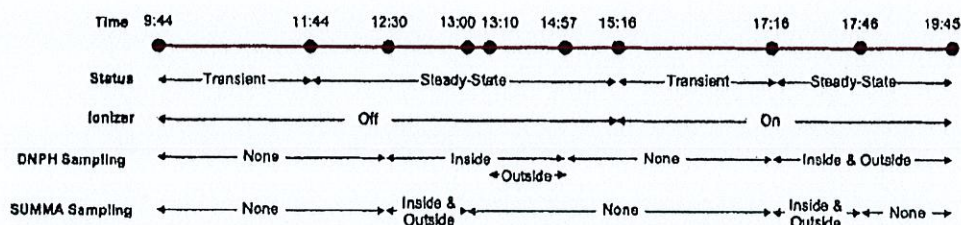


Fig. 2. Timeline of the VOC sampling day experiments conducted during normal operating conditions (October 15, 2020).

concentrations measured by each instrument (SMPS and OPS, respectively) were calculated at each 1-min measurement interval as the sum of the concentrations measured in each size bin measured by each instrument (i.e., 0.01–0.15 μm for the SMPS and 0.3–10 μm for the OPS). Additionally, integral measures of $\text{PM}_{2.5}$ mass concentrations were estimated at each time interval by calculating the mass concentration in each size bin smaller than 2.5 μm from combination of the SMPS and OPS, assuming spherical shape and constant unit density m [33,34]. We acknowledge that the assumption of unit density may result in an underestimate of $\text{PM}_{2.5}$ mass [35] but it does not affect loss rate estimates.

We used a dynamic mass balance approach to model the time varying inside particle concentration for all SMPS and OPS size bins in the well mixed chamber after the incense sticks extinguished (i.e., in the absence of indoor particle sources), as shown in following Equation (1).

$$\frac{dC_{in}}{dt} = P\lambda C_{out} - (\lambda + k)C_{in} \quad (1)$$

where P is penetration factor (—), λ is the air change rate of the chamber (1/hr), k is the particle deposition loss rate constant (1/hr), C_{out} and C_{in} are the outside and inside particle concentrations at time t , respectively ($\#/\text{cm}^3$ or $\#/\text{m}^3$).

To solve for the total particle loss rate constant ($\lambda + k$), we used a first order linear regression solution to the natural logarithm of the particle concentration data measured inside the chamber minus that measured inside the chamber during background conditions applied only to the decay period, as shown in Equation (2).

$$-\ln \frac{C_{in,t} - C_{bg}}{C_{in,t=0} - C_{bg}} = (\lambda + k)t \quad (2)$$

where $C_{in,t}$ and $C_{in,t=0}$ are the inside particle concentrations at time t and $t=0$, respectively. C_{bg} is the average particle concentration measured inside the chamber during approximately steady-state conditions either immediately prior to or after the particle injection and decay periods.

For each test using CO_2 as a tracer gas, the air change rate (λ) was estimated by regressing the natural logarithm of the inside and outside CO_2 concentrations versus time, as shown in Equation (3).

$$-\ln \frac{Y_{in,t} - Y_{out}}{Y_{in,t=0} - Y_{out}} = \lambda t \quad (3)$$

where $Y_{in,t}$ and $Y_{in,t=0}$ are the CO_2 concentrations (ppm) measured inside the chamber at time t and $t=0$, respectively. Y_{out} is the average CO_2 concentration (ppm) measured outside the chamber using a second monitor during the test period. The two CO_2 monitors had been previously calibrated to each other via co-location tests.

2.2. Field measurements (Oregon, USA)

A separate set of measurements were made at a field site in Oregon, USA with an operating 'needlepoint' bipolar ionization system (again, GPS FC18-AC) installed in the air handling unit (AHU). The study site was a 360 m^2 office building that was occupied during the measurements. Between five and eight people were present for the duration of monitoring, and two other individuals also entered the space for short durations. The building was served by two AHUs and an ionizer unit was installed into both air handlers. We conducted sampling upstream and downstream of the ionizer unit in the AHU that served a conference room, two offices, a restroom, and an archive room, consisting of ~170 m^2 of floor area. The supply duct was approximately 0.61 m $\times$ 0.53 m and the design supply air flow rate was 1000 ft^3/min (1700 m^3/h).

We conducted air sampling in four locations in the building: 1) ~0.75 m upstream the ionizer unit in the supply duct, 2) ~0.75 m downstream the ionizer unit in the supply duct (Fig. 3), 3) in the outdoor air supply duct, and 4) inside an 11.5 m^2 office served by the AHU where upstream and downstream sampling occurred. At each location, we measured particulate matter, size-resolved in 27 bins between 0.01 μm and 10 μm using a TSI Model 3910 Nanoscan SMPS and a TSI Model 3330 OPS, O_3 using a 2B Technologies Model 106-OEM-L, and VOCs sampled onto AirToxic glass sorbent tubes (PerkinElmer), packed with 180 mg of Carbotrap B followed by 70 mg of Carboxen 1000, and analyzed by thermal desorption-gas chromatography-mass spectrometry (TD-GC-MS). Details regarding the TD-GC-MS method are provided in Appendix 3. In all locations except the location downstream of the ionizer, temperature and relative humidity were measured continuously (Onset, S-THB-M002).

The ionizer unit in the field location was turned on at the beginning of the workday, ~8:00 a.m. local time, with measurements beginning at approximately 11:30 a.m. local time. The ionizer remained on for the duration of the tests. For measurements made in the supply duct, we measured air pollutant concentrations over a 1 h period. For particle measurements, we sampled air upstream and downstream of the ionizer through two runs of ~1.5 m of $\frac{3}{8}$ " conductive tubing (bev-a-line) that was installed through a sampling port drilled into the aluminum duct. Every 5 min, we manually switched the line attached to the instruments from the upstream to downstream (or vice versa), recording the timestamp of the switch in a laboratory notebook. For ozone, we similarly sampled from air upstream and downstream the ionizer through two runs of ~1.5 m of $\frac{1}{4}$ " perfluoroalkoxy (PFA) tubing, switching every 5 min manually. Upstream of the ionizer system, we inserted the temperature and relative humidity (RH) probe into the center of the supply air duct. Particles, ozone, temperature, and RH were all recorded in a 1-min interval. VOC measurements were time-integrated in each location upstream and downstream the ionizer, with two sampling pumps

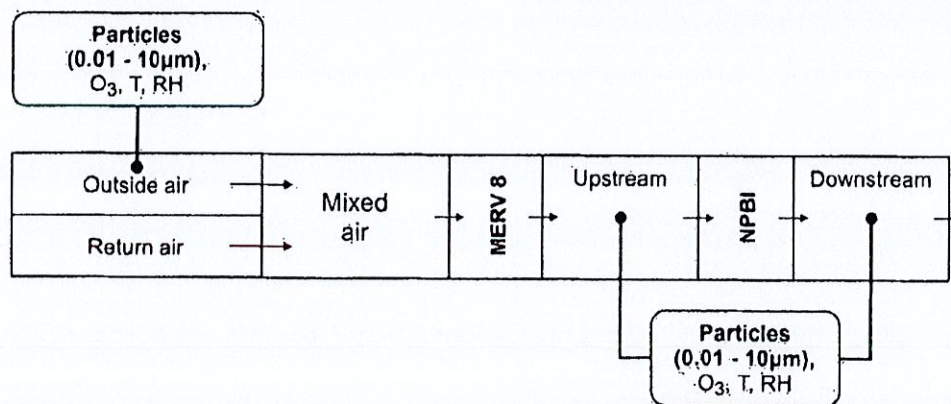


Fig. 3. Schematic of the AHU in the field site with sampling locations marked. Arrows indicate the direction of airflow through the AHU. MERV – Minimum efficiency reporting value, NPBI™ = needlepoint bipolar ionizer, O_3 = ozone, T = temperature, RH = relative humidity.

Indoor Air Quality Technology Company, Global Plasma Solutions

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CHARLOTTE, N.C., March 9, 2020 /PRNewswire/ -- While this epidemic moves closer to a pandemic, industries are wrestling with how to represent the effectiveness of their solutions in helping to control the spread of this outbreak; misinformation is soaring. The reality is that the newness of this pathogen means that there is limited access to test data or the testable pathogen. At present, we can only reference what we know.

In 2018, Global Plasma Solutions (GPS) enlisted ELITE-rated labs to confirm that within 30 minutes, the GPS-patented technology demonstrated substantial reductions of common pathogens. ELITE labs found substantial reductions in each pathogen tested, including Clostridium Difficile (C Diff), Staphylococcus (Staph), Methicillin-resistant staphylococcus aureus (MRSA), Escherichia coli (E. Coli), and Legionella.

As a leader in Indoor Air Quality (IAQ) technology, GPS understands the role indoor air plays in the spread of these diseases. Global Plasma Solutions CTO Charlie Waddell commented: *"We are eager to refresh and expand our third-party test data to further demonstrate the effectiveness of our ionization technology."* The company is announcing today that another round of testing is being conducted immediately against the largest set of pathogens they have tested to date, including a human Coronavirus, and will test COVID-19 upon availability.

Just as pathogens evolve, GPS continues to invent new ways to improve indoor air; engineering and testing advanced methods to clean indoor air and reduce harmful threats.

"Engineering Air for a Cleaner World."

Media Inquiries: Global Plasma Solutions, contact: Kevin Boyle for more information.

Company: Global Plasma Solutions

Point of Contact: [Kevin Boyle](#)

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Guidance for Building Operations During the COVID-19 Pandemic

BY LAWRENCE J. SCHOEN, P.E., FELLOW/LIFE MEMBER ASHRAE

The HVAC systems in most non-medical buildings play only a small role in infectious disease transmission, including COVID-19.¹ Knowledge is emerging about COVID-19, the virus that causes it (SARS-CoV-2), and how the disease spreads. Reasonable, but not certain, inferences about spread can be drawn from the SARS outbreak in 2003 (a virus genetically similar to SARS-CoV-2) and, to a lesser extent, from transmission of other viruses. Preliminary research has been recently released, due to the urgent need for information, but it is likely to take years to reach scientific consensus.

Even in the face of incomplete knowledge, it is critically important for all of us, especially those of us in positions of authority and influence, to exercise our collective responsibility to communicate and reinforce how personal choices about social distancing and hygiene affect the spread of this disease and its impact not just on ourselves, but on our societal systems and economy. The consequences of overwhelming the capacity of our health-care systems are enormous and potentially tragic. The sooner we “flatten the curve,”² the sooner we can return to safer and normal economic and personal lives.

According to the WHO (World Health Organization), “The COVID-19 virus spreads primarily through droplets of saliva or discharge from the nose when an infected person coughs or sneezes....” Talking and breathing can also release droplets and particles.³ Droplets generally fall to the ground or other surfaces in about 1 m (3 ft), while particles (aka aerosols), behave more like a gas and can travel through the air for longer distances, where they

can transmit to people and also settle on surfaces. The virus can be picked up by hands that touch contaminated surfaces (called fomite transmission) or be re-entrained into the air when disturbed on surfaces.

SARS infected people over long distances in 2003,⁴ SARS-CoV-2 has been detected as an aerosol in hospitals,⁵ and there is evidence that at least some strains of it remain suspended and infectious for 3 hours,⁶ suggesting the possibility of aerosol transmission. However, other mechanisms of virus dissemination are likely to be more significant, namely,

- direct person to person contact
- indirect contact through inanimate objects like doorknobs
- through the hands to mucous membranes such as those in the nose, mouth and eyes

Lawrence J. Schoen, P.E., is president and principal engineer at Schoen Engineering, Inc., in Columbia, Md. He was chair of the committee that wrote the most recent version of the “ASHRAE Position Document on Airborne Infectious Diseases.”

- droplets and possibly particles spread between people in close proximity.

For this reason, basic principles of social distancing (1 to 2 m or 3 to 6.5 ft), surface cleaning and disinfection, handwashing and other strategies of good hygiene are far more important than anything related to the HVAC system.⁷ In the middle-Atlantic region of the United States where I work, malls, museums, theaters, gyms and other places where groups of people gather are closed and there are “stay at home”⁸ orders. This is a “game” of chance, and the fewer individuals who come in close contact with each other, the lower the probability for spread of the disease. Since symptoms do not become apparent for days or weeks, each of us must behave as though we are infected.

Other public buildings, considered essential to varying degrees, remain open. These include food, hardware and drug stores, and of course, hospital and health-care facilities (which are beyond the scope of this article). Anecdotally, some universities are allowing some or all faculty, staff and graduate students to conduct essential research and online classes. Banks and other service organizations are open to staff and are receiving customers by appointment only, and private and government workplaces are open with work at home for some or all encouraged or mandated.

For those buildings that remain open, in addition to the policies described above, non-HVAC actions include:

- Increase disinfection of frequently touched surfaces.⁹
- Install more hand sanitation dispensers, assuming they can be procured.
- Supervise or shut down food preparation and warming areas, including the office pantry and coffee station.
- Close or post warning signs at water fountains in favor of bottle filling stations and sinks, or even better, encourage employees to bring their water from home.

Once the basics above are covered, a few actions related to HVAC systems are suggested, in case some spread of the virus can be affected:

- Increase outdoor air ventilation (use caution in highly polluted areas); with a lower population in the building, this increases the effective dilution ventilation per person.
- Disable demand-controlled ventilation (DCV).
- Further open minimum outdoor air dampers, as high as 100%, thus eliminating recirculation (in the mild

weather season, this need not affect thermal comfort or humidity, but clearly becomes more difficult in extreme weather).

- Improve central¹⁰ air filtration to the MERV-13¹¹ or the highest compatible with the filter rack, and seal edges of the filter¹² to limit bypass.
- Keep systems running longer hours, if possible 24/7, to enhance the two actions above.
- Consider portable room air cleaners with HEPA filters.
- Consider UVGI (ultraviolet germicidal irradiation), protecting occupants from radiation,¹³ particularly in high-risk spaces such as waiting rooms, prisons and shelters.

Construction sites present unique challenges. Much, but not all, construction work has the recommended social distancing; much, but not all, is outdoors or in partially enclosed and therefore well-ventilated buildings; and many, but not all, workers already use personal protective equipment such as masks¹⁴ and gloves. Governments in some locations have mandated closure of construction sites, while in others work proceeds.¹⁵ Engineers who perform field observations, commissioning or special inspections must consider what work can be postponed, performed remotely, or conducted using photographic documentation, and what personal precautions to take when site visitation is unavoidable.

If you, the reader, are called upon to advise building operators, please use the above general guidance, and be sure to combine it with knowledge of the specific HVAC system type in a building and the purpose and use of the facility. Like all hazards, risk can be reduced but not eliminated, so be sure to communicate the limitations of the HVAC system and our current state of knowledge about the virus and its spread.

We all have a role to play to control the spread of this disease. HVAC is part of it and even more significant are social distancing, hygiene and the influence we can have on personal behavior.

Thanks to William P. Bahnfleth, Ph.D., P.E., Presidential Member/Fellow ASHRAE, Lew Harriman, Fellow ASHRAE, Yuguo Li, Ph.D., Fellow ASHRAE, Andrew K. Persily, Ph.D., Fellow ASHRAE, and Pawel Wargocki, Ph.D., Member ASHRAE for their review of preliminary drafts of this article. Any errors that remain are the author's alone.

Endnotes

1. According to the WHO, COVID-19 is the name given on February 11, 2020 by the ICTV (International Committee on Taxonomy

of Viruses) to the disease caused by SARS-CoV-2, aka the novel coronavirus. Hospitals and health-care facilities are beyond the scope of this article, though many of the same principles apply to them.

2. "NIH Director: 'We're on an Exponential Curve'", *The Atlantic*, Peter Wehner, March 17, 2020.

3. Bischoff 2013. References cited with only a name and date in this article are taken from *ASHRAE Position Document on Airborne Infectious Diseases*, 2014, 2020 ("PD"). According to the PD, there is no exact size demarcation between droplets and particles, and this "... is less important than knowing that large droplets and small particles

behave differently and that the latter can remain airborne."

4. Yu et al. 2004; Li et al. 2005a, 2005b. References from *ASHRAE Position Document on Airborne Infectious Diseases*.

5. "Aerodynamic Characteristics and RNA Concentration of SARS-CoV-2 Aerosol in Wuhan Hospitals during COVID-19 Outbreak," non-peer reviewed preprint. *bioRxiv*, posted March 10, 2020.

6. "Aerosol and Surface Stability of SARS-CoV-2 as Compared with SARS-CoV-1," letter to the editor *New England Journal of Medicine*, March 17, 2020, DOI: 10.1056/NEJMc2004973.

7. Non-health care workplaces fall into the medium and lower exposure risk categories described in *Guidance on Preparing Workplaces for COVID-19*, U.S. Department of Labor, Occupational Safety and Health Administration OSHA 3990-03 2020.

8. Stay at home orders have been incorrectly called "shelter in place." The latter is a more extreme action advised when there is an outdoor contaminant, which is not the COVID-19 situation. See <https://emergency.cdc.gov/planning/shelteringfacts.asp>.

9. To paraphrase the words of the singer-songwriter Joe Jencks, janitors, cleaners, nurses, aides, doctors, EMTs and other first responders are our "viral firefighters," the advance guard in the fight against this virus.

10. This applies to systems that deliver air to the occupied space and, to a lesser extent, room air returned to rotary heat exchangers, in order to reduce cross contamination.

11. MERV-13 is approximately equivalent to F7, a rating used in the EU. More effective filters with reasonable pressure drop are available, and some increased pressure drop often results in an acceptably small effect on system performance.

12. Consider the filters contaminated, protect personnel changing them, and seal them in plastic bags for disposal.

13. There is research that shows UVGI in both the upper-room and in-duct configurations can inactivate some disease-transmitting organisms. Either of these takes time to plan and install. For more information, see the ASHRAE PD previously cited and Chapter 62 Ultraviolet Air and Surface Treatment of 2019 *ASHRAE Handbook—HVAC Applications*.

14. N95 masks are in short supply and some contractors are donating them to medical facilities, according to *Engineering News Record* March 18, 2020 "Construction Firms Respond to Mask Donation Need."

15. *Engineering News Record*, March 19, 2020. "Pennsylvania Halts All 'Non-Life-Sustaining Business' Operations, Including Construction."

A version of this column first appeared in ASHRAE Journal Newsletter. ■



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Red Phone Booth Installs Air Purification, 'Disinfection Technology' In Anticipation of June 1 Reopening

Speakeasy was 'already utilizing the latest technology in air purification since we offer an extensive cigar program' but enhancements 'set the gold standard in guest safety and comfort.'

POST BY: CALEB J. SPIVAK



MAY 12, 2020



ONE COMMENT



In addition to our normal news coverage, What Now Atlanta is tracking ways Atlanta's businesses are adapting to the novel coronavirus and the challenges it brings to brick-and-mortars.

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Downtown speakeasy **Red Phone Booth** will reopen its doors on **Monday, June 1** after “acquiring the latest in air purification technology and sanitizing solutions,” the restaurant Tuesday announced in a press release.

Global Plasma Solutions installed **Needlepoint Bipolar Ionization**

(NBPI) technology that “purifies air by eliminating airborne particulates, odors, and pathogens by attacking and killing viruses, mold spores, and bacteria,” according to the release.

This air filtration technology is reportedly used in many hospitals like Boston Children's Hospital, the Mayo Clinic and Houston Memorial Hospital Baylor UMC as well as The White House and major universities such as Clemson and Harvard.

Red Phone Booth's new cleaning protocols also include “frequent disinfecting measures applied throughout the facility from floor to ceiling using Clean Well's healthcare grade disinfectant MonoFoil D that kills 99.9 percent of bacteria on surfaces.”

“This EPA approved solution bonds to most surfaces providing an active germ barrier for 30-60 days,” according to the release.

Other safety measures will include staff uniformed with masks and gloves, reservations, staggered arrival times, half capacity, and social distancing seating as well as frequent sanitization procedures.

“Safety for our guests is of the utmost importance at Red Phone Booth,” **Stephen de Haan**, the restaurant’s co-founder, said.

“We were already utilizing the latest technology in air purification since we offer an extensive cigar program. With the installation of the Bipolar Ionization generators and MonoFoil D, our facility will set the gold standard in guest safety and comfort.”

Restaurants were allowed to reopen dining rooms as of Monday, April 27, so as long as owners implemented 39 state-issued guidelines.

Brewers at 4001 Yancey Installing Bi-Polar Ionization System to Improve Air Quality and Eliminate Pathogens in its Space

Mainstay of Charlotte Brewery Scene Partners with Global Plasma Solutions to Provide Clean Air, Safer Environment for Guests and Staff in Wake of COVID-19

NEWS PROVIDED BY

Artisanal Brewing Ventures →

May 26, 2020, 11:45 ET

CHARLOTTE, N.C., May 26, 2020 /PRNewswire/ -- The uncertain times of COVID-19 has pushed one of Charlotte's largest and most popular breweries to re-examine all aspects of its business in order to be able to better serve its guests once it was allowed to reopen. Brewers at 4001 Yancey, the Charlotte home to Victory Brewing Company, Southern Tier Brewing Company, Sixpoint Brewery, and Bold Rock Hard Cider, will be re-opening following all the requisite guidelines laid out by the CDC and state government. It has also reinvented its menu to allow for maximum social distancing by the kitchen staff as well as how food and drinks are served to minimize lines and the number of contacts by its staff. But it was looking to do more.

"The goal was to come back from this challenge stronger than ever. We started by asking our customers what they wanted or needed to feel comfortable and safe. We received over 7,000 responses to the survey and it guided us in making our choices about safety, operational process, and communication," said John Coleman, CEO of Charlotte-based, Artisanal Brewing Ventures, the owner and operator of Brewers at 4001 Yancey.

"We have a built-in advantage in consumers' minds due to our large overall footprint and so much outdoor seating. But we needed to do something inside our space and we didn't feel like distancing our tables, wearing masks and sanitizing surfaces was enough. Our customer

survey told us we needed to do more. So, we looked at adding new technology to our HVAC system that cleans the air, deactivates viruses and other pathogens and provides an additional layer of protection," continued Coleman.

Brewers at 4001 Yancey partnered with Charlotte-based Global Plasma Solutions (GPS), a leading manufacturer of air quality solutions. Brewers at 4001 installed the GPS Needlepoint Bipolar Ionization (NPBI) technology throughout its brewery and taproom. THE NPBI products purify the air by eliminating airborne particulates, odors, and pathogens. The system emits a high volume of ions that steal away hydrogen from the pathogens, driving them out of the air space, leaving clean, healthy indoor air. GPS is installed in more than 150,000 locations worldwide, including Duke University Medical Center and Charlotte Douglas Airport.

"Facilities around the world are utilizing NPBI technology to enhance indoor air quality. It is exciting to be a part of Brewers at 4001 Yancey's reopening strategy. It is obvious their management team is doing what it takes to make their taproom a safe, healthy destination for Charlotteans who are ready to get back out and socialize safely," said Scott Gugenheim, Executive Vice President of Sales at Global Plasma Solutions.

"Sometimes in crisis, there is opportunity. We tried to use this time as an opportunity to raise our game and to craft a better experience for our guests and, at the same time, create a safer working environment for our staff. This has been a trying time for everyone. When our customers decide it's time for them to come back out, we want to be there to deliver for them and make them feel like they are safe here with us." said Coleman.

Brewers at 4001 Yancey will re-open its doors to the public on May 27th with a full menu crafted by award-winning chef, Drew Ward, indoor and outdoor table seating, and over 40 craft beers, ciders, and seltzers ready to serve.

About Brewers at 4001 Yancey.

Brewers at 4001 Yancey opened in June 2018 as the flagship taproom, brewery and office space for Artisanal Brewing Ventures (ABV). ABV was founded in 2014 as a platform that supports like-minded independent craft breweries in their growth ambitions. ABV brings expertise, resources and support to its partner breweries but safeguards their culture and respects their

local craft soul. ABV brings top-tier craft adult beverage brands together and unlocks their potential for growth. Through mergers and partnerships in high-volume, craft-centric markets east of the Mississippi, ABV is building a portfolio of preeminent brands, including Sixpoint, Southern Tier, Victory, and Bold Rock. The company is a top ten craft brewer in the U.S. and has a leadership position in eight of the country's top 50 markets for craft beers. ABV is headquartered in Charlotte, North Carolina, and has operations in Brooklyn, NY, Lakewood, NY, Cleveland, Pittsburgh, and metro Philadelphia.

About Global Plasma Solutions

Global Plasma Solutions (GPS) is the leader in indoor air quality technology. Headquartered in Charlotte, N.C., GPS' needlepoint bipolar ionization (NPBI) delivers a safe, maintenance-free solution that reduces airborne particulates, deactivates pathogens, eliminates odors and saves energy. GPS was founded in 2008 and has more than 150,000 installations worldwide. GPS technology is UL2998 certified for zero ozone and have the CE marking.

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Global Plasma Solutions Virtually Eliminates Static SARS-CoV-2 with Proprietary NPBI™ Technology

Global Plasma Solutions is the first air purification solution to test SARS-CoV-2, achieving a 99.4% reduction of the surface strain within 30 minutes

June 10, 2020 02:30 PM Eastern Daylight Time

CHARLOTTE, N.C.--(BUSINESS WIRE)--Global Plasma Solutions, the leader in Indoor Air Quality, announced today industry-leading ionization testing results, demonstrating a 99.4% reduction rate on a SARS-CoV-2 (COVID-19) surface strain within 30 minutes, the first instance in which an air purification company has effectively neutralized SARS-CoV-2. Following initial testing of coronavirus 229E in March 2020, Global Plasma Solutions utilized its proprietary [needlepoint bipolar ionization](#) to inactivate SARS-CoV-2. The study was jointly executed with [Aviation Clean Air](#).

“For any kind of facility from commercial buildings to aircrafts, delivering the cleanest, safest indoor air environment will only become increasingly more important, and our ozone-free technology is one of the

most sophisticated products on the market.”

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In this laboratory study, Aviation Clean Air designed a test to mimic ionization conditions like that of a commercial aircraft's fuselage. Based on viral titrations, it was determined that at 10 minutes, 84.2% of the virus was inactivated. At 15 minutes, 92.6% of the virus was inactivated, and at 30 minutes, 99.4% of the virus was inactivated.

“The testing results we achieved through our proprietary needlepoint bipolar ionization technology clearly demonstrate that Global Plasma

Solutions is the gold standard in air purification,” said Global Plasma Solutions Founder and Chief Technology Officer, Charles Waddell. “For any kind of facility from commercial buildings to aircrafts, delivering the cleanest, safest indoor air environment will only become increasingly more important, and our ozone-free technology is one of the most sophisticated products on the market.”

Understanding needlepoint bipolar ionization

Needlepoint bipolar ionization works to safely clean indoor air, leveraging an electronic charge to create a high concentration of positive and negative ions. These ions travel through the air continuously seeking out and attaching to particles. This sets in motion a continuous pattern of particle combination. As these particles become larger, they are eliminated from the air more rapidly.

Additionally, positive and negative ions have microbicidal effects on pathogens, ultimately reducing the infectivity of the virus. Global Plasma Solutions' needlepoint bipolar ionization is ozone-free and the only kind in its category to pass the RCTA DO-160 standard for aircraft. Traditional bipolar ionization systems produce harmful ozone as a byproduct.

About Global Plasma Solutions

[Global Plasma Solutions](#) (GPS) is the leader in Indoor Air Quality, with over 30 patents and more than 150,000 installations worldwide using our needlepoint bipolar ionization (NPBI) technology to deliver clean indoor air that is safe and healthy – producing neither ozone nor other harmful by-products. All of our NPBI products are UL and CE certified and registered and use NPBI to purify the air by eliminating airborne particulates, odors and pathogens. GPS was founded in 2008 and is headquartered in Charlotte, North Carolina.

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Pellston Public Schools to install air filter system in schools to help prevent COVID-19

by Paul Steeno

Tuesday, June 16th 2020



Pellston Public Schools will be installing about 110 air scrubbers from Global Plasma Solutions to help filter the air inside their school buildings to help prevent the spread of COVID-19 during the upcoming school year. (Global Plasma Solutions/Paul Steeno/WPBN)

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Sounds like something a lot of people would be interested in, right?

Pellston Public Schools has bought one, investing \$48,000 to install about 110 of the new air filter machines to make the inside air just as fresh and clean as the air outside throughout the district.

"It was horrible. It was like everybody's heart was ripped out," said Pellston Public Schools Superintendent Stephen Seelye. "It's difficult and there are some learning gaps we will have to catch up on next year but what I stated was I didn't want to go to one funeral - one funeral of anybody I loved."

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Pellston is using money from its sinking fund millage passed in March to add COVID-19 fighting technology.

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They will install about 110 air scrubbers from Global Plasma Solutions.

The technology eliminated nearly all of COVID-19 in a lab test.

The company said the technology works on both air and surface particles but that numbers could vary when used outside a lab setting.

"We got to make sure that they are safe, emotionally, physically and next year safety takes a whole new meaning with the pandemic and coronavirus," said Seelye.

There are other safety projects keeping head of maintenance and grounds Michael Chapman busy this summer.

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A worker cleaning the lights at Pellston Public Schools. (Paul Steeno/WPBN)

"It's very time-consuming."

Projects include installing copper handles on doors and making sinks, soap and paper towel dispensers no touch.

"We want to make sure our parents feel like their kids can come to a safe environment and not have to stress," said Chapman.

The company claims the air scrubbing units can also kill things like Tuberculosis, E. coli and MRSA.

The school said they will have the air scrubbing technology installed by the start of the school year.

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WEB ONLY

FEATURED

Greensboro Day School Invests in Global Plasma Solutions Air Purification System

By Susan Davis

Global Plasma Solutions is the first air purification solution to test SARS-CoV-2, achieving a 99.4% reduction of the surface strain within 30 minutes.

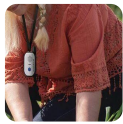
Greensboro, NC - Greensboro Day School (GDS) announced it is installing an air purification solution in every classroom and building on the school's campus. Global Plasma Solutions (GPS) uses Needlepoint Bipolar Ionization System (NPBI) to purify the air. This type of system is used by leading healthcare systems, airlines, convention centers, and universities.

Pollutants, dust, allergens, mold, bacteria, and viruses are all common types of particles in the air. The patented NPBI technology from Global Plasma Solutions uses positive and negative ions to collide with many of these particles. The collision creates a larger particle with a charge that attracts even more particles with opposite polarity, eventually resulting in larger and larger particles that are easier to capture in a filtration system. Additionally, contact with these ions disrupts the pathogens surface proteins, rendering many of them inactive.

According to Global Plasma Solutions, "NPBI is a patented technology that uses an electronic charge to create a plasma field filled with a high concentration of positive and negative ions. As these ions travel with the air stream they attach to particles, pathogens, and gases. The ions help to collect fine sub-micron particles, making them filterable. The ions kill pathogens by robbing them of life-sustaining hydrogen. The ions breakdown harmful VOCs with an Electron Volt Potential under twelve (eV<12) into harmless compounds like O₂, CO₂, N₂, and H₂O. The ions produced travel within the air stream into the occupied spaces, cleaning the air everywhere the ions travel, even in spaces unseen."

“As we plan to return to campus on August 19, the safety for our students, employees, and community members is our number one priority,” stated Tracie Catlett, Head of School. “By installing the GPS air purification system, in addition to our new cleaning and sanitizing protocols, health and temperature screenings, and physical distancing guidelines, we can bring our community back to school safely.”

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About Greensboro Day School: Established in 1970, Greensboro Day School is a Pre-K – 12th Grade independent school serving the Triad region of North Carolina. The school enrolls over 800 students, 28% students of color, and has a student-teacher ratio of 7:1. In 2020, the school awarded \$2.5 million in financial assistance. Greensboro Day School's mission is to develop the intellectual, ethical, and interpersonal foundations students need to be constructive contributors to the world.

About Global Plasma Solutions: Global Plasma Solutions, based in Charlotte, NC, has over 30 patents and more than 150,000 installations worldwide using their patented Needlepoint Bipolar Ionization (NPBI) technology. This technology delivers clean air to notable installations including the White House, Google, Mayo Clinic, Harvard University, and the Charlotte Douglas Airport. In North Carolina, Global Plasma Solutions products can be purchased through Hoffman & Hoffman, Inc. with installation by Hoffman Mechanical Solutions, Inc.



Vanbarton Group Installs First High-Rise Bipolar Ionization System in Seattle

Real estate investment firm adds advanced air purification devices at 901 Fifth Avenue to maximize safety

October 09, 2020 09:00 AM Eastern Daylight Time

SEATTLE--([BUSINESS WIRE](#))--[Vanbarton Group](#) (Vanbarton), a privately owned vertically integrated real estate investment and advisory firm, announced the installation of the NeedlePoint Bipolar Ionization (NPBI) system at 901 Fifth Avenue, the first high-rise implementation in Seattle. The installation of NPBI at the downtown Seattle office tower is part of Vanbarton's ongoing efforts to enhance its buildings' air quality and help reduce the transmission of airborne illnesses, such as the novel coronavirus.

NPBI technology is integrated into buildings' HVAC systems and has been cited as a powerful purification method to maintain healthy air quality and to mitigate harmful substances such as mold, bacteria and viruses. Vanbarton has installed this technology because providing a safe working environment for its tenants continues to be a top priority. Other users of NPBI technology include Boeing, Cleveland Clinic, Google and the Mayo Clinic.

Vanbarton partnered with [System Inc.](#), a Seattle-based manufacturer representative, designer and installer of air quality control equipment and [Global Plasma Solutions](#) (GPS), a leading manufacturer of indoor air quality solutions, to test the efficacy of NPBI for the building. Upon successful completion and validation of test results, the groups installed 36 air purification devices throughout the 41-story office building. NPBI devices in 901 Fifth Avenue have been placed in all seven central air handling systems. The remaining 29 supplementary devices are located at variable air volume (VAV) locations serving conference rooms and common areas for maximum protection. The patented technology cleans the air inside commercial and residential buildings by using an electronic charge to create a plasma field filled with a high concentration of positive and negative ions. As these ions travel with the air stream, they attach to particles, pathogens and gases.

"The global pandemic has emphasized the vital role building systems, cleaning technology and ongoing building maintenance play in protecting the public health of our communities," said Doug Edwards, General Manager of Engineering with Schnitzer West, who manages the property on behalf of Vanbarton. "We take this responsibility seriously and remain committed to ensuring the health, safety and overall well-being of our tenants and visitors to our buildings. As more of the global workforce returns to their offices, it's imperative that this transition is safe. We're grateful for the collaboration with System Inc. and GPS to help safeguard our building environment and deliver the best possible air quality for our tenants."

Since the outbreak of COVID-19, commercial landlords around the world have been focused on providing a clean and healthy work environment so their tenants and other building occupants can safely return to their offices. Using the NPBI technology in conjunction with high efficiency filtration and property hygiene protocols can help address this concern. According to independent studies commissioned by GPS, NPBI can reduce 99.7 percent of microbes, and has already provided effective protection against SARS, norovirus and several influenza strains in other buildings where it has been installed.

Vanbarton is currently reviewing the installation of the NPBI technology at some of its other properties in New York, San Francisco and Los Angeles. 901 Fifth Avenue, which Vanbarton purchased from Schnitzer West in July 2019, recently earned a LEED Platinum rating, which is the highest sustainability rating a building can attain within the LEED rating system.

About Vanbarton Group

Vanbarton Group is a privately owned, vertically integrated real estate investment and advisory firm founded in 1992 with corporate offices in New York City, San Francisco and Seattle. With its proven expertise successfully investing across the capital stack in varying ways throughout real estate cycles, Vanbarton's investments include core, value-to-core and value-add equity investments, preferred equity, junior participations, bridge loans, secondary market debt acquisitions and securitized credit. To find out more about Vanbarton, please call 212-293-8800, or visit the firm's website at www.vanbartongroup.com.

About Global Plasma Solutions

Global Plasma Solutions (GPS) is the leader in Indoor Air Quality, with over 30 patents and more than 250,000 installations worldwide using our needlepoint bipolar ionization (NPBI) technology to deliver clean indoor air that is safe and healthy – producing neither ozone nor other harmful by-products. All of our NPBI products are UL and CE certified and registered and use NPBI to purify the air by eliminating airborne particulates, odors and pathogens. GPS was founded in 2008 and is headquartered in Charlotte, North Carolina.

About System Inc.

System Inc. is a Seattle based manufacturer representative, designer, and installer of air quality control equipment. Since 1963, System Inc. has specialized in the refurbishment, renewal and upgrade of commercial and industrial HVAC equipment serving building and process applications. System Inc. helps owners maximize equipment lifecycles and reduce replacement expenses using an engineered whole system approach.

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NEWS



Bipolar Ionization Units installed in Gloucester Co. Schools

By: [Erin Miller](#)*Posted at 5:11 PM, Dec 18, 2020 and last updated 5:24 PM, Dec 18, 2020*

GLOUCESTER Co., Va. - As second-graders at Petsworth Elementary School in Gloucester sit in class, their only concern is answering the next question, not wondering what viruses may be in the air.

Students, teachers and staff have peace of mind because up on the roof, and throughout the schools, a new filtration system is hard at work.

"[You'll find it in] every unit [at] every school. If it's heating and air equipment, then it has a unit in it," said Energy Specialist Kevin Buchanan.

Inside of the HVAC units located at the schools, there is a blue attachment called a Needlepoint Bipolar Ionization Unit.

According to Global Plasma Solution, the company that manufactures a patented NPBI technology, "NPBI is capable of helping improve ventilation and filtration by influencing the removal of small airborne particulate from the environment based on the principle of electrostatic attraction. Ions, like those already prevalent in cleaner outdoor air, are artificially generated within the HVAC system so that when released and distributed throughout the building, they mix with room air and attach to airborne particles. As these charged particles are increasingly attracted and joined to one another, their size and weight is increased to the point where they are now large and heavy enough to be removed with the HVAC system's air movement. They can now be effectively removed from the space and exhausted, filtered or treated."

On Friday, News 3 Reporter Erin Miller was there as Gloucester County Public Schools finished installing the technology in every building.

Superintendent Dr. Walter Clemons calls this a big win for the district. "We look at this as being a mitigation strategy to ensure that we, as a school division, are doing all that we can to keep our students, our staff, and our families safe," he said.

Using CARES Act funding, the County Board of Supervisors covered the cost of the units, which was \$923,488. In total, the school district received over \$2.8 million from the Board of Supervisors, which allowed them to receive the Needlepoint BiPolar Ionization Units, 12 new school buses, Samsung Galaxy Tablets, & MiFi & WiFi devices.

The units are currently up and running as 97% of staff work on-site and students learn in a hybrid environment.

"We felt that if we were going to have all of our students back, we wanted to add layers of protection to ensure safety," Clemons said.

While the main goal is to [mitigate the spread of COVID-19](#), NPBI will also help keep allergies, mold, mildew and other dust particles out of the air. Administrators said this will be a long-term benefit for students and teachers.

[non-relevant material deleted]

News 3 also reached out to other school districts to see if they had plans to purchase Needlepoint Bipolar Ionization. Their responses are below:

Newport News Public Schools

Newport News Public Schools has purchased portable air purifiers for each classroom in all buildings where the HVAC system does not meet the ASHRAE standard. These air purifiers have HEPA filters which remove small particles to include viruses and bacteria from the air.

NNPS has shared the following with our staff and families: a building's heating, ventilation and air conditioning (HVAC) system provides clean air by bringing outside air into the building and filtering the air. The organization that provides regulatory guidance for HVAC systems, the American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) recommends five air changes per hour; this is a standard supported by Harvard Healthy Buildings, a program of the Harvard University School of Public Health. In buildings where there are relatively new HVAC systems, NNPS is meeting this standard. In other NNPS buildings where HVAC systems are not able to meet this standard, the NNPS Plant Services team is implementing two options to improve ventilation in classrooms:

For classrooms and offices that have windows, opening them just a small amount can increase the air exchanges, but the team knows some buildings do not have windows or the windows are not operable, and on some days, the weather does not permit this option. To address the need for increased ventilation in classrooms, NNPS has purchased portable air purifiers for each classroom in all buildings where the HVAC system does not meet the ASHRAE standard.

Portsmouth Public Schools

At this time, the school division does not have air purifiers in schools. However, the school division has increased its frequency of changing air filters. PPS does have many safety features in effect for the return students in the new year. For example, custodial staff deep cleans classrooms everyday; there are touchless hand sanitation units in schools; floor markers to ensure social distance; and the 77-passenger school buses will only transport 22 students to ensure social distancing. These are just a few of the strategies.

The Auxiliary Services staff meets regularly to discuss necessary safety purchases. I understand that the possible purchase of air purifiers will be a discussion point in the future.

Hampton City Schools

Hampton City Schools has been installing bi polar ionization devices into HVAC units as we upgrade systems. In addition, earlier this year, the division purchased nearly 3,000 HEPA air purifiers for every classroom, library, clinic, and office space as well as replacement filters. The filters are rated

HEPA 13 and are a true HEPA filtration system. They are a combination HEPA and charged filter. They filter 99.9% of

particulate matter in the air every 30 minutes.

Chesapeake Public Schools

Filters/ filtration:

CPS utilizes the max MERV rated filters as determined by equipment specific manufacturer recommendations.

Currently all HVAC systems throughout the school division receive filter changes every 90 days. CPS hires an outside agency to perform this work. Change out schedule is based on manufacturer specifications and ASHRAE guidelines.

Ventilation/ Ventilation systems:

All CPS buildings have been designed in accordance with State and Local building codes. HVAC systems mechanically introduce outdoor air at code-specified CFM rate that is calculated using the max occupancy of the space.

Consideration of additional HVAC equipment; i.e HEPA filtration and bipolar ionization:

- HEPA filters: CPS has purchased stand alone air purifiers for use in designated isolation (sick) rooms and clinics in each school. This determination was based on the increased likelihood that sick individuals will be occupying these spaces.
- Bipolar Ionization: CPS consulted with a mechanical engineering firm regarding the feasibility of adding bipolar ionization to existing systems. Based on design and operating parameters of existing systems, the addition of bipolar ionization has not been recommended at this time.

Virginia Beach City Public Schools

According to the American Society of Heating, Refrigeration, & Air Conditioning Engineers (ASHRAE) Epidemic Task Force and the International Facility Management Association (IFMA) Pandemic Manual, one of the most important things an HVAC system can do to

combat COVID-19 is to operate properly to effectively control indoor space temperature and humidity

Since the inception of the pandemic, Virginia Beach City Public Schools (VBCPS) has focused heavily on maintaining proper HVAC system operation while executing multiple, focused preventative maintenance (PM) initiatives throughout the school district. PM initiatives include emergency response for HVAC systems, filter replacement, dilution/flush through extended building operation, indoor environment assessment through data logging, HVAC equipment preventative maintenance, and HVAC equipment coil cleaning.

Over the past decade, VBCPS has incorporated various types of air purification technologies into new building design and HVAC replacements (when appropriate) including bi-polar ionization, ultraviolet treatment, HLR technology and increased filtration.

SCHOOL & DISTRICT MANAGEMENT EXPLAINER

Air Purifiers, Fans, and Filters: A COVID-19 Explainer for Schools



By [Mark Lieberman](#) — October 27, 2020 ⌚ 10 min read



High school students take a physical education class at their school gym in Gifu, central Japan, on June 1, 2020. Air ventilation measures have been taken in schools all over the world to reduce the risk of coronavirus infection.

— Kyodo via AP Images

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COVID-19 is surging in nearly every state, and public health experts are warning that colder temperatures and increased indoor activity will mean the virus is likely to remain an urgent threat for the foreseeable future.

At the same time, schools are grappling with the potentially devastating effects of learning loss, social isolation, and diminished access to vital offerings for millions of students who haven't been in a physical classroom since March.

Faced with limited resources and uncertain prospects for relief from the federal government, schools are in desperate need of clear, definitive guidance for reopening buildings safely and maintaining in-person instruction over the long haul. Some teachers in Boston have been posting pictures of their classrooms on social media and asking for guidance on whether their schools' mitigation efforts are sufficient. (Boston officials have since since closed school buildings due to a surge in COVID-19 cases.)

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The role that air ventilation and filtration plays in slowing the spread of the virus is complex and has been confusing for educators to parse. Some schools have been scrambling to upgrade their HVAC systems and placing bulk orders for air purifying devices for classrooms. But questions remain about the effectiveness of these measures and the precise approaches that are most likely to succeed.

Education Week interviewed three experts on public health and air management, and a veteran school facilities director, about ventilation, filtration, air purifiers, and related mitigation measures. Here's what they recommend schools prioritize in the months ahead.

Why is clean air important for mitigating viral spread?

COVID-19 particles can live in the air for up to three hours. More ventilation (air movement) and better filtration (air cleaning) can cut down on the number of airborne particles that linger when an infected person coughs or exhales indoors. Airborne infection is 15 to 20 times more likely to occur indoors than outdoors.

What are the key elements for good air quality in a school building?

1. How much outside air gets into the building.

The more the better, says Mark Benden, director of the Ergonomics Center at the Texas A&M University School of Public Health. The ideal scenario would be a 72-degree day with windows fully open, which would mean the indoor air is essentially indistinguishable from the outdoor air.

2. How much air inside the building recirculates from one place to another.

"If the air is being pulled away from us very rapidly, greater than six times per hour, we don't have very much chance to breathe the same air," Benden said.

3. How often the indoor air gets filtered (cleaned) before being recirculated.

The faster the indoor air gets pushed through a strong filter, the less likely it will be that someone will breathe in viral particles from another infected person in the same room, Benden said. He

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difference to an N-95 mask and a cloth mask—both are effective, but one is much stronger than the other.

The American Society of Heating, Refrigerating and Air-Conditioning Engineers also recommends schools use a MERV-13 filter or higher.

Keith Watkins, assistant director of facilities for the New Rochelle district in New York and current president of the National School Plant Management Association, has implemented MERV-15 filters in his district's school buildings. But some schools' mechanical systems can't support such strong filters, he said.

Why weren't these upgrades made before COVID-19?

A federal watchdog group found earlier this year that [41 percent of school districts](#) needed to update or replace their air systems in at least half their schools.

Schools that have poor air quality tend to be hamstrung by costs, Benden said. They use cheap or outdated air systems that don't bring in much outside air or clean the indoor air as often as would be ideal.

"Since COVID, I think the blinders are off everyone," he said. "Everyone that has responsibility in this area is in touch with their groups and they're saying, 'We really need the best filters.'"

(For more on this topic, read Education Week's reporting from August on the [wide variation in schools' HVAC capabilities](#).)

Does opening the windows help?

Yes. Opening windows even a couple inches "can really increase the number of air changes in the room" said Joseph Gardner Allen, a professor of public health at Harvard University.

He recommends schools keep windows open as much as they can even when the weather gets cold in some parts of the country. "Even if that means kids have to wear a heavier sweater, it's the simplest, most cost-effective strategy," he said.

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Experts agree that stronger filters for the school's existing ventilation system are a higher priority than individual air purifiers for each classroom.

"The things that I'm proposing, you probably should do for general better air quality anyway, for cold and flu," Benden said. "If you are going to buy something that you plugged into the wall, get a vaccine in the spring, then unplug it and throw it away, should you have bought that? No, probably not."

Allen believes portable air purifiers are only essential if a school is otherwise unable to improve its existing systems for a higher building-wide filtration rate. They should be used along with universal mask-wearing, social distancing, and frequent hand washing.

Watkins' district is not allowing air purifiers in classrooms—some are less effective than others, he said, and most are more effective in an average bedroom than an average classroom. "There were quite a few requests for them [from teachers] and they were all declined," Watkins said.

However, many schools lack mechanical filtration systems that can withstand filters strong enough to adequately mitigate viral spread. That is why many have already been evaluating their air systems since COVID-19 shut down school buildings nationwide in March. Red flags to look out for include closed dampers, motors that have been turned off, and filters that were installed haphazardly or incorrectly.

"It's akin to a tune-up for your car. The building needs a tune-up too," Allen said.

In those cases, portable HEPA air purifiers are a worthwhile tool, he said.

A "HEPA" (high-efficiency particulate air) filter is most commonly found in the air systems of hospitals and airplanes. They "can theoretically remove at least 99.97% of dust, pollen, mold, bacteria, and any airborne particles with a size of 0.3 microns," according to the [Environmental Protection Agency](#).

How do I know which air purifier to get?

School districts should coordinate the purchases of purifiers for their buildings so they are

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Allen helped build this [online tool](#) to help schools figure out which devices will be most effective. Important considerations include the size of the room, the number of people who will be in it, and the typical arrangement of people within the space.

Schools may need to consult a local engineer or commissioning agent (someone who oversees and advises on building design) to advise the best products for buildings, and the best placement for classrooms, said Corey Metzger, chair of the schools team for ASHRAE's epidemic task force.

These decisions have high stakes: A poorly placed air purifier could inadvertently push air with infected particles from one part of the room to another. A loud filter that drowns out a teacher's voice while operating at full strength could become less effective if it gets turned down to a lower setting. Some classrooms might benefit from two medium-strength filters rather than one that's at full strength, Metzger said.

ASHRAE is working on a short document to help schools figure out their air purifier needs, Metzger said. In the meantime, the organization has developed [detailed guidance for schools on air ventilation and filtration](#).

What about filters that have UV rays? Are those safe?

No, in fact, those devices might even be dangerous, Benden said. Some get hot quickly and could be fire hazards. Others emit odors or toxic gases like ozone that can be harmful to people at high volumes.

"What do we need? We need clean, breathable air. What do we not need? We need to not cause problems. We need to not run up the bill for electricity," Benden said.

What about fans?

Small desk fans for a classroom likely wouldn't hurt, Benden said, but they won't make a meaningful difference for slowing the spread of COVID-19.

Larger fans placed near an open window could be useful for accelerating the spread of outdoor air in schools with no working HVAC system. But they could also blow viral particles away from the

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Twelve percent of school districts are offering full-time in-person instruction, and another 65 percent are offering in-person instruction to some extent, according to a survey conducted earlier this month by the EdWeek Research Center. While there have been scattered reports of outbreaks, schools generally had not experienced significant COVID-19 spread in their buildings through mid-October. To Benden, that's an encouraging sign that schools are taking ventilation, filtration, and other precautions seriously.

"We can dial up our current systems to really optimize, and we can do that with what we've got," Benden said. "It's working." (Read [this Education Week article](#) for more on in-person instruction during COVID-19.)

A national database of school building reopenings, focused on drawing lessons from success stories, would be useful as more schools aim to reopen in the next couple months, Allen said. Similarly, states can do more to help—the Arizona state agency required to inspect school buildings' ventilation systems, for instance, hasn't conducted reviews of school buildings this year, the Arizona Republic [reported this month](#).

Watkins has installed air particulate meters that can provide data on particles on surfaces and in the air. His district plans to use those numbers to inform future decisions on upgrading air systems, he said.

I am a teacher. Who can I ask to learn more about my school building?

In many cases, school and district facilities managers will have detailed information about ventilation and air filtration. Some can even change settings on fans and filters in the school's air infrastructure remotely from their computers, Benden said.

Are air purifiers in short supply?

Several schools in [Massachusetts](#) and [Rhode Island](#) delayed the start of in-person instruction after air purifier shipments hadn't arrived due to supply chain issues. Those delays are likely to persist as demand for these devices continues.

Allen lamented that many schools have had to turn to searching for guidance on the internet and

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Will all this investment in improving air systems pay off in the long run?

Almost certainly. The same systems that filter out COVID-19 particles are simultaneously removing allergens, dust mites, skin flakes, and other particles that can trigger allergies and asthma in many students. One study in Los Angeles prior to the pandemic found improving schools' air quality could [lead to better test scores for students](#).

The District of Columbia's public school system has [spent \\$24 million on HVAC upgrades](#) in preparation for school buildings to [partially reopen next month](#). Watkins said upgrading air systems in his district cost around \$250,000, but in a smaller district, the price tag could be as low as \$35,000. His association, which has facilities directors from schools in 22 states, has been an invaluable resource during a time when many long-established protocols have to be rethought.

"After 30 years, I feel like my career has started all over again," he said.



Mark Lieberman

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Mark Lieberman is a reporter for Education Week who covers school finance.



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Schools are spending millions on ionization technology to fight COVID and there's no good evidence it works

Published: Jan. 22, 2021, 10:28 a.m.

By Ross Pomeroy | RealClear Politics

In October, Tulare City School District in California [announced](#) it would spend more than \$400,000 to install needlepoint bipolar ionization technology into the ventilation systems of its 15 schools. Gloucester County Schools in Virginia [completed](#) a similar undertaking in all of its buildings in December. The bill? \$923,488. Anoka-Hennepin School District in Minnesota recently [spent](#) \$1.4 million installing the technology in all of its schools.

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Near [identical stories](#) are [playing out](#) in public school [districts across](#) the United States – with total expenditures in the tens of millions of dollars, perhaps more – as officials search for solutions to protect classrooms from the novel coronavirus. Unfortunately, in this case, school administrators may have fallen for snake oil, and taxpayers are footing the bill.

Re



According to [the makers](#) and [marketers](#) of needlepoint bipolar ionization technology, when installed into existing ventilation systems, their relatively small devices create and release ions into the airstream. “When these ions disperse throughout a space, they seek out and form bonds with particles in the air through a process called agglomeration,” Global Plasma Solutions (GPS) [claims](#). “This creates a snowball effect in which particles begin to cluster together. The larger a cluster of particles becomes, the easier it is for your system to safely filter it out of the air.”

The company previously [touted](#) that their products inactivated 84.2% of coronavirus particles after 10 minutes; 92.6% after 15 minutes; 99.4% after 30 minutes.

But that claim has since disappeared from GPS' website. Replacing it is a disclaimer: "The use of this technology is not intended to take the place of reasonable precautions to prevent the transmission of pathogens. It is important to comply with all applicable public health laws and guidelines issued by federal, state, and local governments and health authorities as well as official guidance published by the Centers for Disease Control and Prevention (CDC), including but not limited to social distancing, hand hygiene, cough etiquette, and the use of face masks."

There's no such disclaimer on the website of PlasmaAir, another maker of the technology. Instead, the company [features a 28-page summary](#) of laboratory research to support their claims of efficacy. But the cited studies are unconvincing. Most tested the ionization devices on small rooms or tiny chambers without sufficient controls. Moreover, none of the research is peer-reviewed.

In an [interview with NBC News](#), William Bahnfleth, a professor of architectural engineering at Penn State University, was skeptical of ionization filtration. "Much of the proof of their performance is in the form of laboratory studies commissioned by manufacturers that are often performed under conditions that are not representative of actual application conditions."

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L. James Lo, an assistant professor of civil, architectural and environmental engineering at Drexel University, [told NBC](#) that this sort of technology may not have much of an effect in real-world situations.

If a person is sitting next to someone who has COVID-19 and is generating so-called aerosols by talking or coughing, “and you are there for [an] extended period of time, you will still likely get infected,” he said.

“Most coronavirus transmission occurs from direct close, unmasked interactions that are unlikely to be impacted by ionization,” Dr. Michael Kaiser, former CEO of the Louisiana Public Hospital System, [said](#). “Placing ionizers into the environment would not preclude the need to frequently wash hands, socially distance, and wear a mask.”

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) [does not currently have a formal position](#) on bipolar ionization, but they do offer caution:

“Relative to many other air cleaning or disinfection technologies, needlepoint bi-polar ionization has a less-documented track record in regards to cleaning/disinfecting large and fast volumes of moving air within heating, ventilation, and air conditioning (HVAC) systems. This is not to imply that the technology doesn’t work as advertised, only that in the absence of an established body of evidence reflecting proven efficacy under as-used conditions, the technology is still considered by many to be an “emerging technology”

ASHRAE adds, “Convincing scientifically-rigorous, peer-reviewed studies do not currently exist... Systems may emit ozone, some at high levels.”

[Ozone](#), or trioxygen, is a powerful oxidant that can acutely or chronically harm respiratory health depending upon the concentration.

GPS insists that their products are safe and certified as “ozone-free”.

Personal air purifier ionization devices have been sold to the public for some time, but [according to the Mayo Clinic](#), they are generally not beneficial, and can exacerbate symptoms of asthma due to the creation of ozone in the air. Broader health effects have not been explored.

“My understanding is the possible adverse effects of ionizers, whether directly from inhaling them or from impacts on uptake of particulate matter in the respiratory system are not well studied,” Bahnfleth [said](#).

While school districts are probably not putting their pupils at much risk by installing bipolar ionization devices, they’re likely not making them any safer from COVID-19 either, and wasting millions of dollars in the process.

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Lehigh Valley schools look to emerging tech to make sure buildings are safe for classes: bipolar ionization

By KAYLA DWYER
THE MORNING CALL | JAN 24, 2021



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It's not often that school board directors need a science lesson before deciding to spend hundreds of thousands of dollars.

Over the last year, as the science evolved on COVID-19 and best practices to mitigate the spread of the virus, several districts in the Lehigh Valley decided to pursue an air purification strategy that the Centers for Disease Control and Prevention still considers an "emerging technology," though its basic principles are as old as the Earth's atmosphere.

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In normal times, using a process called bipolar ionization to clean the air would seem a luxury for schools. These days, it appears to be one more thing school boards can do, often with money available from state-distributed coronavirus relief grants, to try to make schools safer.

So at least four Lehigh Valley school districts have installed or are getting ready to install the unimpressive blue boxes in their HVAC systems.

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“If it keeps one kid from getting sick, so be it,” Allentown schools Facilities Director Tom Smith said.

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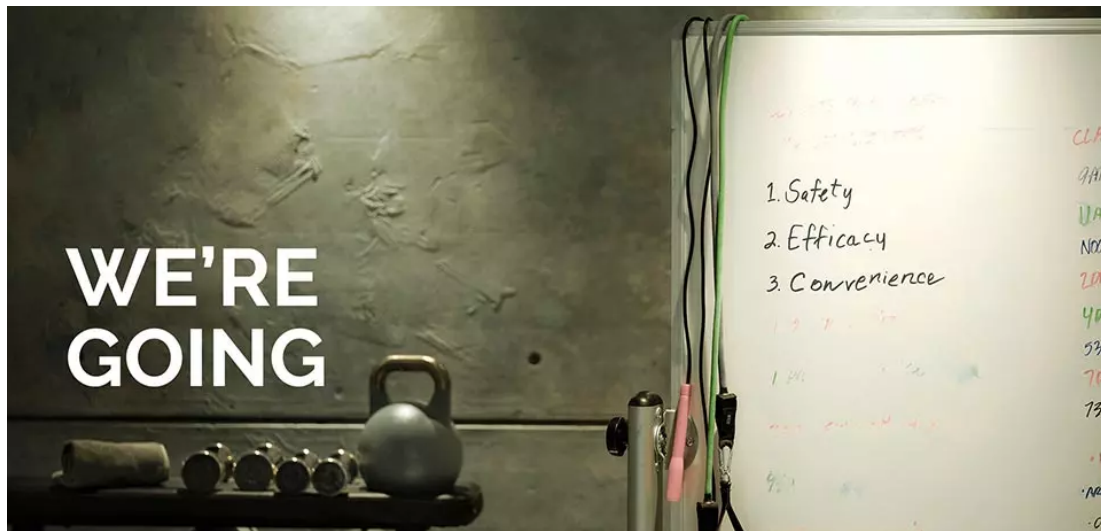


Tim Kopiak of McClure Co. installs a bipolar ionization unit in the HVAC system in a classroom of Northwestern Lehigh High School in early January. (Contributed Photo/Northwestern Lehigh)

The needlepoint bipolar ionization devices send positive and negative ions through the air ducts. The ions act like magnets, merging with air particles to make clumps that are easier for filters to catch. When viruses are present, the charged ions pull hydrogen away from their coats — in the case of the coronavirus, the spikey outer shell is made up of proteins that need hydrogen to survive. Thus, the ions inactivate the virus.

“Where we see naturally occurring ions in the world around us are the places that people go on vacation to get cleaner air,” John Gunning, senior mechanical engineer with McClure Co., explained to Northwestern Lehigh School Board in December. Think higher-elevation places like mountains and waterfalls.

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Bipolar ionization units are just one of several strategies Gunning's team might present to school boards when asked for possible air-purifying solutions. Since the second round of federal coronavirus relief funding is anticipated to be much larger than the first, his company has, in the past few months, fielded more requests.

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Though it's yet to be vetted by independent experts or regulatory agencies, bipolar ionization tends to rise to the top of the list, Gunning said, since it's flexible with existing HVAC systems and has a long life expectancy — about 10 years.

This school year, Kutztown Area School District was the first locally to outfit all its buildings at a cost of \$250,000, before the start of the fall semester. Northwestern Lehigh installed units in early January for \$350,000. Allentown School District bought nearly \$472,000 worth of devices that are now being installed, and Northern Lehigh School Board voted Jan. 11 to procure them for about \$250,000.

For the most part, the districts are using federal coronavirus relief money, though Northwestern Lehigh used part of the \$475,000 it had leftover from a high school construction fund.

“This seems like a godsend at this point in time with what we’re facing,” Northwestern Lehigh School Board President Willard Dellicker said at a December meeting.

FEEDBACK

This kind of purchase would have been out of the question for an underfunded district like Allentown had there not been relief money available, Smith said.

“Unfortunately, these are luxury items. They shouldn’t be, but they are,” he said. “The grant has given us the ability to level the playing field.”

Still, the districts all faced a common challenge: Among the sea of products emerging during the pandemic that claim to sanitize and purify, which can be trusted?

Even the efficacy of bipolar ionization is still under review with a newly formed epidemic task force at the American Society of Heating, Refrigerating and Air-Conditioning Engineers — the industry experts who set standards for HVAC, among other systems.

“Convincing, scientifically rigorous, peer-reviewed studies do not currently exist on this emerging technology; manufacturer data should be carefully considered,” the organization states on its website.

The CDC, too, considers it an emerging technology because, though the process is old, its application to HVAC systems is new. In the past 20 years or so, bipolar ionization has mainly been marketed toward odor-elimination, such as in locker rooms or cosmetology labs.

“As with all emerging technologies, consumers are encouraged to exercise caution and to do their homework,” the CDC wrote in response to an ASHRAE inquiry.

Third-party test data about bipolar ionization's impact on the coronavirus arrived in May, which made the option more mainstream for places like schools, Gunning said.

The experiment, conducted by an Innovative Bioanalysis lab on a device made by manufacturer Global Plasma Solutions, found that after 30 minutes of being exposed to needlepoint bipolar ionization, 99.4% of the viral particles became inactive.

FEEDBACK

McClure conducted its own tests on the air quality in Kutztown's buildings a month after installation of the Global Plasma Solutions product. It couldn't test for viral content in the air, but the tests showed improved air quality: far more ions and far fewer clumpy air particles.

"Nobody guaranteed us that bipolar ionization was going to solve this issue, and certainly it hasn't," Kutztown Superintendent Christian Temchatin said. "But it was the most effective solution that our engineers could recommend to help improve air quality for our students."

The driving force, he said, was a desire to bring students back for in-person learning full time, which Kutztown did in August for kindergarten through eighth grade students (students could still opt for virtual learning).

That lack of guarantee is a main reason Stephen Angstadt, senior project manager at Barry Isett and Associates, hasn't specifically recommended these or other air purifiers to his clients. Plus, he said, the odds of transmitting the virus out of one's mouth, into the ceiling air ducts, out a supply grill and to another person are very unlikely, compared with breathing in the virus from a person sitting nearby.

"For this reason," an [article in ASHRAE Journal](#) on guidance for building operations during COVID-19 states, "basic principles of social distancing (1 to 2 m or 3 to 6.5 ft), surface cleaning and disinfection, handwashing and other strategies of good hygiene are far more important than anything related to the HVAC system."

Angstadt said clients have also come to him asking about ultraviolet light, a proven technology used in hospitals and, lately, [nursing homes](#). These, however, have to be placed strategically where people aren't exposed to the radiation for too long. Another strategy touted over the years, the use of ozone, has gone by the wayside for its potentially harmful respiratory side effects.

FEEDBACK

Earlier versions of bipolar ionization devices might have emitted some ozone, but, “many of the earlier potential safety concerns are reportedly now resolved,” the CDC says.

Gary Debes, president of the Lehigh Valley chapter of ASHRAE, called bipolar ionization a “good first step,” though the national organization does not yet have a firm position or guidance on its use.

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“This is a very new issue that is extremely complex, so there will most likely be updated recommendations from ASHRAE as this virus is studied further,” he said.

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In the meantime, school leaders are moving ahead, looking at the technology as just one more mitigation layer on top of social distancing and hygiene..

“At the core, it’s just doing all we can to mitigate the negative effects of the virus,” Northern Lehigh Superintendent Matthew Link said.

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