

Data Mining: Comparisons and Contrasts from the Cincinnati Workshop

Michael T. Postek, The University of South Florida, Tampa, Florida,

and

Troy Cowan, IUVA, Lexington Park, Maryland

Purpose

This presents a high-level preliminary observational analysis of the data obtained from 2022 Americas Conference in Cincinnati, OH. This compares and contrasts the most important issues and goals between four stakeholder groups. The purpose of this paper is to synthesize this information and distill and prioritize into a primary set of issues & goals as input for IUVA's June Roadmapping workshop on "Achieving Consensus on Germicidal Ultraviolet (GUV) in Public Spaces," described below.

Introduction

Last September, IUVA staged its 2022 Americas Conference in Cincinnati, OH, addressing developments and issues of efficiency, performance, and safety of UV applications for water, air, surfaces, and food. On Wednesday, the IUVA Healthcare Task Force led a special interactive discussion on the latest trends in germicidal ultraviolet (GUV) technologies for healthcare. The discussions featured representatives from the federal government, NGOs, academia, and industry--with updates on infectious diseases, and a dialogue on GUVI in the context of looking ahead to the next ten years.¹

The panelists were asked to provide their comments on two questions for GUV technologies: "Where are we and where are we going in the next 10 years?" In response to the questions, four panels with a total of twenty-one panelists presented over 170 narrative goals and issues² looking ahead the next 10 years. These goals and issues were then cross-walked into 14 broad categories (Table 1) for further development in a follow-on road-mapping workshop "Achieving Consensus on Germicidal Ultraviolet (GUV) in Public Spaces" Workshop, planned for June 6-8, 2023. The purpose of this paper is to synthesize this information and distill and prioritize into a primary set of issues & goals as input for the June Road mapping Workshop.

Methods

- The narrative contributions from all 21 speakers and slides were analyzed and any technically pertinent issues and or goals presented were logged.

Pre-publication Copy

- More than **170 narrative** entries were analyzed and categorized into **14 overarching issues and goals** as seen in **Table 1**.

1	Efficacy Testing	8	Education Outreach
2	Trained Workforce	9	Labeling/ Prod Info
3	IAQ/ Public Health	10	New Technology Research
4	Standards & Guidelines	11	Cost
5	Regulatory Guidance	12	Far UV
6	Proven Safety	13	Installation Commissioning
7	Proven Performance	14	Collaboration

*Note: the order and number assigned to each Issue and Goal will be maintained throughout

- The tabular data points were analyzed, compared, and contrasted between the 14 categories among each group of speakers to determine the most important topics between stakeholders' groups. Results of the analysis are summarized, below –
- The percentages denote the degree of implied consensus amongst the panelists that these categories are important.

The frequency of these data demonstrated by these 14 issues and goals, is presented in this work to induce inter group dialog for the upcoming Atlanta Workshop. The main goal will then be to synthesize these issues and determine potential solutions for identifying an achievable subset and in addition, to ultimately converge the groups into an understanding of the state of the technology and what can be done to improve its acceptance and to get a more consistent consensus of categories of immediate interest, or what they should be, and determine a plan to attack them.

The Panels

Federal Panel – This panel was designed to help provide insights into what the Federal Government Agencies see as the primary challenges over the next 10 years and how they would consider working with industry to help in their mitigation. The Panel consisted of seven representatives of the federal government from :

- White House Office of Scientific Programs (WH-OSTP)
- Pacific Northwest National Laboratory (PNNL) representing Dept. of Energy,
- Food and Drug Administration (FDA),
- National Institute for Occupational Safety and Health (CDC/NIOSH),
- National Institute of Standards and Technology (NIST),
- Occupational Safety and Health Administration (OSHA)
- Environmental Protection Agency (EPA)

Pre-publication Copy

While these panelists were not empowered to present or define governmental policies, their insights were used to get an understanding of agency priorities and direction regarding the topic of GUV.

Panel 1: Research & Development Infectious Disease Experts -This panel of four research scientists, experts in the infectious disease world presented their insights and expertise on the latest biological threats and their thoughts for looking ahead. Represented in this panel were senior scientists from a major Federal medical center, and the schools of medicine, environmental engineering, and of public health from three prestigious US universities.

Panel 2: Original Equipment Manufacturer (OEM) panelists from GUV Product Suppliers/SME's. In this panel, five senior OEM representatives, including three CEO's and two Sr. Vice Presidents, described where and how their products are being used currently and what pressing challenges are being faced in adoption of their technologies. The panelists were also invited to comment on what they saw as industry trends in adapting to the new situations predicted in the previous panel.

Panel 3: GUVI-related Industry Associations. The panel included seven representatives from major industry associations involved in GUV technologies and applications. They included International Ultraviolet Association (IUVA), Institute of Education Sciences (IES), American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE), National Electrical Manufacturers Association (NEMA), International Electrotechnical Commission (IEC), International Organization for Standardization (ISO-TC/142) and the Global Lighting Association (GLA). These associations and organizations described where they and their members are going and what they see as industry trends in adapting to the new situations predicted in the previous sessions.

Results

An effort was made to determine the level of “consensus”, or relative agreement between the panelists, on the importance of a given category. To do this, the number of **identified narrative goals relative to each individual panel** was calculated as a percentage of the total number of narratives obtained. This is shown in **Table 2**. In this case, the higher the percentage, the higher the four panel's level of consensus was demonstrated in the particular issue or goal. Colors were assigned to those with no discernable consensus (grey), perceived growing consensus (yellow), mild consensus (light green), strong consensus (blue) and overwhelming consensus (red).

**Table 2
Identified Narrative Goals Relative to Each Individual Panel**

	Federal Panel	Research Panel	OEM Panel	Association Panel	Results across All Panels
Efficacy Testing	28.89%	59.52%	73.08%	55.00%	55.0%
Trained Workforce	11.11%	4.76%	34.62%	60.00%	27.0%
IAQ/Public Health	35.56%	88.10%	96.15%	100.00%	80.0%
Standards & Guidelines	35.56%	59.52%	92.31%	90.00%	70.0%
Regulatory Guidance	17.78%	42.86%	78.85%	85.00%	56.0%
Proven Safety	26.67%	35.71%	90.38%	62.50%	55.0%
Proven Performance	17.78%	47.62%	88.46%	60.00%	55.0%
Education Outreach	33.33%	57.14%	94.23%	77.50%	66.0%
Labeling Product Information	13.33%	23.81%	84.62%	90.00%	54.0%
New Technology Research	8.89%	28.57%	21.15%	22.50%	20.0%
Cost	4.44%	16.67%	48.08%	25.00%	25.0%
Far UV	4.44%	4.76%	9.62%	5.00%	6.0%
Installation Commissioning	11.11%	4.76%	40.38%	57.50%	28.0%
Collaboration	13.33%	64.29%	98.08%	100.00%	69.0%

Key to the colors	
Grey Fill => No discernable consensus (0-23%)	Dark Green Fill => Moderate consensus (74-90%)
Yellow Fill => Growing consensus (24-48%)	Blue Fill => Strong consensus (91-94%)
Light Green Fill => Mild consensus (49-73%)	Red Fill => Overwhelming consensus (95-100%)

Analysis

As stated above, the purpose of this paper is to synthesize the information and distill and prioritize it into a primary set of issues & goals. These data then will provide input for IUVA’s June Roadmapping workshop on “Achieving Consensus on Germicidal Ultraviolet (GUV) in Public Spaces.” Some of the findings that can be derived from these data are:

- The highest rated goal was public health in all panels.
- There is strong consensus regarding collaboration and it is of great interest to the majority of the panels.
- Although cost is cited as an important factor in at least one of the presentations, there is little consensus that this is an important issue, overall.
- There only seems to be little consensus for new technology research as an issue.

Pre-publication Copy

- The most highly rated goals were from the OEM panel where they rated IAQ/public health, standards and guidelines, proven safety and performance and education as the highest priorities.
- Comparison of the Government panel's consensus to the other three panels is generally low. That is expected since the government mission space is quite broad. Depending upon the agency involved, they have specified mission space to assist or regulate US business once the need has been identified. This is also reflected in the lower number of goals logged in comparison to the other panels.
- Concerns regarding a trained workforce had a low consensus of interest although the interest was understandably higher for the OEMs and Associations

Additional Observations resulting from the Panels.

- In the Federal Panel,
 - OSHA specifically stated that they are actively **partnering** with academic and governmental groups to support the development of performance and measurement standards. This is strong evidence that there are collaborative efforts underway, even if somewhat isolated.
 - EPA reminded the attendees that many users may not use prudent disinfection processes if they believe they are fully protected by GUV technologies, which may not apply in all cases.
- In the R&D Panel, it was observed that:
 - Even though GUV technologies have been used for almost a century, the available peer reviewed literature providing evidence of the efficacy of UV is really suboptimal. One example is where good lab advances have shown UV is effective against *Candida auris*, however a recent survey of PubMed showed *a lack of published data* proving that UVC does in fact, reduce the *Candida auris* that occurs in hospital rooms. So, because of the lack of publications, we are working with incomplete evidence.
 - There is conflicting guidance regarding the application of GUV. For example, CDC acknowledges that UVC is effective against *Candida auris*, yet it makes no recommendation that it should be considered for application to UV saying that there is not enough evidence (see above). In addition, looking at the current practice guidelines, a number of experts in *C diff* do not recommend the use of UVC since this is considered to be an unresolved issue, and hence by default is not recommended.
 - Epidemiologists are emphasizing risk mitigation in Indoor Air Quality because disinfecting the air we breathe is crucial to help mitigate the risk-based infections and limiting antimicrobial resistance.
 - A looming problem is **antimicrobial resistance**, which existed prior to the COVID-19 pandemic and continues to be a much greater concern especially in the field of infectious diseases. The speaker stated this issue is something that “really brings us to

Pre-publication Copy

our knees when we see a patient with drug resistant pathogen and you don't have any options left for treatment.” Disinfection with GUV, to date, has not been shown result in development of antimicrobial resistant organisms, so using GUV in place of chemical antimicrobials could help mitigate this issue.

- The OEM Panel observed:
 - Testing is paramount. In recent years, there have been many false claims made especially regarding products marketed during the COVID crisis. But effective testing protocols will limit the proliferation of false claims in future outbreaks.
 - Education of potential customers that GUV can lower infection risk, when safely applied, is needed if GUV is to be accepted by the public. This can be facilitated by an increase of scientific evidence, but the industry is small and needs the help of government funding to overcome the research barriers and disseminate the information.
- Observations from the Association Panel included:
 - There is a need for application-relevant standards/certifications, not only for equipment effectiveness and safety, but also to know who is a qualified provider and installer. So, a well-trained credentialed workforce is needed.
 - Additionally, there was voiced a need to unify and simplify GUVI by aligning influential relevant industry groups like IUVA, DOE, IES, ASHRAE, IALD & NALMCO on key GUVI issues.
 - The panel agreed that it is important to ensure GUVI is increasingly recognized as a key element for comprehensive programs to create safer, more energy efficient built environments.

Conclusions

Moving forward, the fundamental interpretation of these data demonstrated by these 14 issues and goals, has been presented in this work to induce inter-group dialog for the upcoming Atlanta Workshop. It is expected that once these data are reviewed, a good deal of dialog may ensue.

However, the main goal is spurring discussion to determine if these are the **right goals**, identify the specific objectives to be addressed and if so synthesize them into potential do-able projects. The expectation is that by converging the groups in a common understanding of the state of the technology and what can be done to improve its acceptance perhaps spurring more of a “thinking out of the box” philosophy to determine a plan to successfully attack them.

¹ IUVA Americas 2022 Agenda for Weds. September 28, 2022
<https://iuva.org/2022-IUVA-AC-Wednesday>

² IUVA Americas 2022 Panelists' Presentations from Weds. September 28, 2022,
<https://iuva.org/resources/2022%20Americas%20Conference/Proceedings/Wednesday%20Session%20Panelists%20Slides%20Combined.pdf>