A Compilation of Manufacturers' Perspectives on the Requirements and Recommendations in the UVDGM

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The recently released draft of the Ultraviolet Disinfection Guidance Manual (UVDGM) by the EPA is a complex guideline governing the use of this new technology in the potable water disinfection market.

Overall the UVDGM is a very welcome addition to the UV disinfection business. It provides legitimacy to the use of UV for the treatment of drinking water and the obtaining of disinfection credits. It helps to level the playing field for all manufacturers to offer systems on an equal footing and along with the proposed rule will open the door for UV to be used in the USA and elsewhere in the world where the USEPA regulations are adopted.

When reviewing the UVDGM from a manufacturer's perspective, specific aspects of the draft can impact the ability for a manufacturer to supply equipment and service into the marketplace. The following is a discussion of these aspects.

1. A New Regulation Can Be An Obstacle to Product Development and Innovation.

The UVDGM addresses this briefly (Introduction, 1.4 Alternative Approaches for Disinfecting with UV-Light). This gives the manufacturers the possibility to alter their technologies and thus the new UVDGM should not be an obstacle to new developments. Acceptance of alternative designs and UV technologies allows for product design innovation and improvement on product operation and efficiencies.

In general the UVDGM should be commended for the manner in which it provides general guidance without dictating specific design solutions and for the scientific basis underpinning all the recommendations. This will allow for improvements to be made to the equipment and methods while still maintaining compliance with the Guidelines.

2. The elements of the UVDGM are complex and may be confusing to the regulators and utilities.

The complexity and scale of the UDVGM is rather high. In general this may result in some reluctance, especially at smaller water utilities, to use UV disinfection if there are alternatives. Nevertheless, it must be noted that, from a manufacturer's point of view, a simple-to-understand booklet summarizing the validation protocol and other complex aspects of the UVDGM would be useful to relay these details to end users and third party consultants. However, the summary should not compromise the flexibility that is currently afforded by the manner in which Section 5.0 details validation protocol. Compromising this detail will limit the end user's ability to see the applicability of various manufacturers' products under various conditions.

3. A highly-regulated technology can yield increased costs.

Due to the complexity of the guidelines, there will be a need for in-house or third party consulting expertise to review and implement them. In comparison to other existing UV standards, the UVDGM is relatively flexible regarding the use of different technologies and does not specify more than is necessary, which is actually one of the reasons for the complexity. These have to be weighed against each other.

A foreseeable problem exists in the regulatory acceptance of validations based on product specific criteria. For example, manufacturer's have piping configurations that might not always correlate to site-specific piping configurations. If the installation of that system follows the currently drafted UVDGM validation protocol, a decision then must be made as to whether or not to re-perform validation to confirm that the difference in piping configuration does not compromise the specific UV product's performance. If a decision to re-perform validation due to these specific circumstances occurs, who bears the financial responsibility to perform the validation? Validating a UV system has proven to be an increasingly costly endeavor further plagued by a lack of available off-site validation facilities that result in timely validations, potentially delaying project schedules.

There is also the potential for the UVDGM protocol to be modified on a state-by-state or even regional basis; similar to the way in which other environmental regulations have been interpreted.

4. Validation of a technology adds additional cost to the supplied product.

The costs of validation are considerable, and must be borne by the manufacturer and ultimately the water industry, warranting a review of the return on investment (ROI) before engaging in any given project. Without adequate ROI, a manufacturer must develop and offer a

selective product offering to the marketplace, limiting the variability of offered products to those that would fall under these guidelines.

It remains to be seen how the market will react to the additional costs as not all the suppliers will be able to reduce their margins in a highly competitive environment, and thus will pass on these costs to the customers. One problem is that the suppliers have to invest significantly before they will get a probable return on this investment. This is not necessarily only the pure investment for the validation, but also the complete infrastructure within the company to manage the process. From the impacts of similar standards in other countries it is quite obvious now, that these kinds of complex validation processes need experienced people within a company who are dedicated full-time to this process. In other words, a company has to invest in new human resources to manage this aspect. There also will need to be a competitive environment on the validation side to put a manufacturer in the position to compare costs and services.

Due to the limited availability of validation facilities and the increased requirements of the UVDGM, manufacturers' costs for performing validation are increasing. This increase forces the manufacturer to evaluate the product variations it offers the marketplace, because each variation, whether it be number of lamps, reactor configuration, lamp wattage, and/or inlet/outlet size, must be validated to prove that the reactor meets manufacturer claims. Therefore, if an end-user needs a special UV system design to meet his/her project demands, the end user will bear the brunt of the costs for validation because there is no possibility of obtaining an ROI on a one-off product design and absorb the validation costs as well. This may reduce the flexibility of UV systems in various installations.

Applying the UVDGM validation and operational guidelines in the field raises several problems that should be evaluated. It is very apparent that the scientific community has had a heavy influence in developing the protocol. Many of the technical requirements for monitoring exceed currently available technology, specifically sensors and UV Transmittance (UVT) monitors.

For UV systems, sensor technologies utilized today most likely will improve over time, thus increasing the accuracy. This improvement, in turn, will reduce the validation uncertainty/-safety factors. This decrease in uncertainty, in time, will increase the efficiency of operating UV systems, helping to reduce the energy costs of operating a UV system. The safety factors, as currently calculated, are causing UV manufacturers potentially to de-rate or oversize their UV reactors in order to supply UV systems into the potable water market that are validated through the UVDGM proposed procedures.

In the case of UVT monitors, the better the accuracy of the instrument, the smaller will be the uncertainty/safety factor within the validation process. A high level of accuracy is impractical for a field instrument. Accuracy of this instrumentation comes with a cost, and could limit technology currently provided by the manufacturing community. Many specifications for potable water UV projects require an accuracy of "1% for the readings offered by the UVT monitor. Manufacturers can supply this accuracy, but it can be provided only at the detriment of real-time data delivery.

The UVDGM also may place medium-pressure UV at a competitive disadvantage compared to other technologies. The Tier 1 reduction equivalent doses (REDs) for inactivation of Cryptosporidium and Giardia (Tables 4.1 and 4.2 within the UVDGM) with medium-pressure UV systems are higher than for low-pressure and low-pressure high output systems. The underlying data and assumptions used to determine the RED values should be revisited to determine if the difference suggested truly exists.

5. The marketplace is lacking the capacity to meet current and future validation demands.

This point again deals more with execution side of the UVDGM rather than with the content itself. Experiences from other countries show that bottlenecks in the capacity to validate systems can have a huge impact on the time required for a manufacturer to bring a product to market. Thus the validation capacity should be planned carefully for both saving costs and securing competition.

The validation process is time-consuming and requires a good deal of operational resources for coordination and execution. Without adequate off-site validation capacity, end-users and third party consultants must perform on-site validation, consuming considerable time, money and resources, in order to meet project demands.

Long wait times and unavailability of adequate validation facilities will slow down the ability of manufacturers to introduce products to the market and to meet project demands. End users and third party consultants may need to consider performing on-site validations as a viable alternative to meet their project schedules.

6. Multiple Global Validation Protocols.

Without a globally accepted general validation protocol, manufacturers are subject to performing multiple validations, which sometimes are just variations on the same theme in order to supply their products in the global potable water marketplace. The presence of a generally accepted validation protocol will help to alleviate market confusion.

The UVDGM is a guidance document and does not demand absolute adherence; therefore manufacturers who have already performed validations under alternative pro-

tocols, such as DVGW, Ö-Norm, NWRI/AWWARF, will not be required to perform another validation for a product already proven under another protocol. The regulatory agencies and third party consultant community must allow alternative validation protocols performed by the manufacturers provided the protocol meets basic minimum requirements and the protocol is able to prove manufacturer claims for product performance.

7. Transparency of Technical Solutions.
This should be the biggest advantage of the UVDGM. Due to a clear specified base, customers will be in the position to make a decision based on the same factors for different kinds of technologies. This creates a fair and transparent atmosphere in which every stakeholder of the process knows exactly what and for what reasons something happens or does not happen.

The guidelines allow for flexibility in UV system design and permits innovation; however, new product offerings need to meet certain minimum standards, as outlined in the UVDGM. The UVDGM promotes a fair and equitable solution for manufacturers and offers a level playing field to maintain a competitive environment. It also sets a basic standard for innovative systems to achieve when introduced to the marketplace.

8. Guidelines create comfort in technology.
The UVDGM provides an opportunity for end users, regulators and third party consultants to feel comfortable installing a UV system that has been evaluated, proving manufacturer claims. The biggest hurdle for the regulatory community has been how one measures the effectiveness of UV light in disinfecting water systems, since there is no current quick, analytical technology to know if a UV system is performing as claimed by the manufacturer. A certain comfort level can be achieved by obtaining operational data from an installed UV system and comparing it to the system's specific validated operating parameters.

9. New guidelines generate attention.
A new guideline like the UVDGM generates a market itself, by forcing people to pay attention to the technology, which they may not have heard of before they became aware of the new guidelines. The USEPA's publication of the UVDGM will allow UV to be introduced into other areas of the world that are still sceptical of using UV for primary potable water disinfection applications. This will provide a big boost to the adoption of UV disinfection worldwide.

SUMMARY

The UVDGM will have a positive impact on implementing UV disinfection systems in potable water applications within the North American market as well as others around the world.

In general, the UV equipment manufacturing community views the following aspects favorably:

1. Projects can be specified on a neutral base, which makes it more transparent for customers to compare between different technologies.
2. The new guidelines will make customers feel more comfortable with the technology.
3. The new guidelines will create more attention for the use of UV in general.
4. The new guidelines incorporate pre-existing validation protocols, helping to eliminate market confusion.

However, one big question in the future will be the situation during the execution of the requirements and especially the validation process. Every step has to be taken to keep the costs down and to avoid bottlenecks to make the technology attractive and available.

The UVDGM is a result of significant effort on the part of the USEPA as well as the UV stakeholders to put forward a protocol inclusive of the best of all previous protocols, NWRI/AWWARF, Ö-Norm, DVGW, and NSF, as well as taking the validation process the next step to include all current UV capabilities and technologies. It will demand that current sensor technology improve over time to allow manufacturers the ability to reduce the uncertainty in their systems and improve the overall operational efficiency. The validation process, requiring manufacturers to stand behind performance claims, will help to improve the quality and consistency of UV products introduced into the marketplace. Steps will need to be taken to reduce the costs of validations to improve manufacturer ROI decisions; this may be accomplished through competition among validation operations and/or increased validation capacity. Also, once the user community develops a comfort level with UV, the requirement to validate may be reduced as manufacturer Computation Fluid Dynamics (CFD) modelling capabilities more closely predict validation results.

As UV disinfection continues to gain popularity for use in potable water applications and implementation of the systems follow approved protocol, utilities and state regulators increasingly will see UV disinfection as viable technology.

EDITOR's NOTE: *The UV equipment manufacturers were asked to submit their comments on the UVDGM for a combined UV manufacturer article in this issue of IUVA News. The intent of this article was to present one contribution that combined the manufacturers' ideas, comments, and issues about the UVDGM. However, contributions were split into two articles because the comments of Trojan Technologies (following) were substantially different from those of the other responding manufacturers.*