

Case Studies on the Effects of Ultraviolet Air Purification on the Air Quality in Hospitals and Clinics

a report by

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Beginning with the most simple of problems and growing into something that requires considerable time, effort and money to solve, mould not only poses a threat to property but has been recorded to present health problems for those who are sensitive to certain moulds when exposed to them. Given the right conditions, mould can grow rampant, growing on everything from fibreboard, gypsum, paper, heating, ventilation and air-conditioning (HVAC) condensate pans and coils. The National Center for Environmental Health (NCEH) describes that the exposure to moulds in some individuals can range in symptoms from “nasal stuffiness, eye irritation, to wheezing. Severe reactions may include fever and shortness of breath. People with chronic illnesses, such as obstructive lung disease, may develop mould infections in their lungs.”

Mould may pose problems to those who are in good health, but should there be a mould problem in a hospital where there are sick and elderly, the risks to these individuals can greatly increase.

Case Study 1

In November 2001, the Charter Springs Hospital in Ocala, Florida, experienced a compressor failure in the 30-ton air-conditioning unit used to cool a wing of the hospital. According to Building Supervisor, Gil Lopez:

“At this time, the building was empty so we decided to postpone replacing the compressor. This was a big mistake. Being in Florida and the high humidity, it only took a couple of weeks for the mould and mildew to take over. It was all over the walls, the ceiling, and the space above the dropped ceiling.”

The task of removing mould from a system is not an easy one and, quite frequently, the mould returns. Mr Lopez explains:

“We hired a professional cleaning service to eliminate the problem. This cleaning was very expensive and took several days to complete. We also, at this time, had the compressor in the A/C unit replaced, hoping we had cured the problem. But, to our surprise, we

noticed the mold had returned. We then had the same company return to clean the wing again. The cost was the same as before and time consuming.”

“A couple of weeks later we noticed the mold had returned for the third time. This time I suggested that we call Clean Air Innovations, Inc. of Ocala Florida to take a look at the situation. Clean Air Innovations, Inc. recommended installing a Sanuvox UV Bio-Wall Ultraviolet System in the A/C system cooling that wing of the hospital. Since the cost of installing the ultraviolet air purifier was a fraction of the cost of the cleaning jobs, we decided to give it a try,” said Mr Lopez. “Before Clean Air Innovations installed the Sanuvox UV Bio-Wall, breathing was very difficult in this wing due to mould spores in the air, we had to wear masks when in this area. In just 3 days after the ultraviolet air purifier was installed, the wing smelled fresh. The mold and mildew disappeared in just a few days, and has not returned. That was over 12 months ago.”

According to Fred Huffman of Clean Air Innovations:

“I was impressed with the ease of installation of the ultraviolet air purification system. It was evident that the purifier was designed to deliver a high degree of ultraviolet energy to the moving air stream.”

Not only did the air purifier destroy the mould in the system, but, Mr Lopez goes on to explain,

“To our surprise, two weeks later we got a bonus. We started to find a large amount of insects dying all over the wing; it was due to the air purification system. The insects were feeding on the mold and mildew. When their food source died, so did the insects.”

Administrator Beth Boone was so impressed with the results, they have agreed to have other ultraviolet (UV) air purifiers installed into the two remaining wings of the facility.

Case Study 2

In October 2003, Golder Associates Ltd were



Table 1: Initial Air-sampling Event Results – Prior to Installation of Bio-Wall UV Air Purifier

Identification	Sample Point Location	Results (Sts/m ³)
1A	Exam Room #2	7,379
2A	Reception	11,500
3A	Fitness Centre	17,681
4A	Laboratory	2,145
5A	Outside and Upwind	17,538

Table 2: Follow-up Air-sampling Event Results – After Installation of Bio-Wall UV Air Purifier

Identification	Sample Point Location	Results (Sts/m ³)
1B	Exam Room #2	186
2B	Reception	93
3B	Fitness Centre	837
4B	Laboratory	372
5B	Outside and Upwind	54,529

retained by Healthy Home Inspections, Testing & Services, Inc. to conduct mould in air-enumeration sampling and analysis within the NatroMed medical facility located in Vancouver, Canada. The purpose of the sampling events was to establish airborne mould concentrations prior to and after the installation of the UV Bio-Wall UV air purifier within the NatroMed suite.

The NatroMed suite comprises a medical facility and a fitness centre. The medical facility consists of several examination and treatment rooms, laboratories, laundry facilities, a kitchen area, storage rooms, offices and reception area. The fitness centre consists of changing facilities, an aerobic, full gym and juice bar.

Initial Air Sampling

Golder Associated Ltd conducted sampling on 21 July 2003. During this time, Healthy Homes had not installed the UV air purifier. The air samples were submitted to the laboratory for bulk enumeration analysis on the day of the sampling. Sample point locations are provided in *Table 1*.

Follow-up Air Sampling

Golder Associated conducted the follow-up sampling event on 15 September 2003, at which point the UV air purifier had been operational for approximately seven weeks. The air samples were submitted to the laboratory for bulk enumeration analysis on the day of the sampling. Sample point locations are provided in *Table 2*.

Conclusion

Based on a comparison of the results of the initial air-

sampling event to that of the follow-up air-sampling event, Golder provided the following opinion:

- The analytical results for follow-up air-sampling event (15 September 2003) indicated airborne mould within the medical facility to be one to three orders of magnitude lower (10–1,000 times) than the sample results for the initial air-sampling event (21 July 2003 prior to the installation of the Sanuvox unit).
- Based on the analytical air sample results, airborne mould levels within the medical facility were judged to be less than that of the outdoor, or background, air sample obtained on the day of the follow-up air-sampling event.

Case Study 3

In a study published 28 November 2003 in *The Lancet Medical Journal*, McGill University scientists found that shining proprietary UV purifiers on the air-conditioning coil reduces overall sickness by 20%, reduces respiratory symptoms by 40% and has resulted in a 99% reduction of microbial and endotoxin concentrations on irradiated surfaces within the ventilation system.

UV germicidal irradiation (UVGI), has been used to disinfect the air in hospital operating theatres and ventilation systems as well as meat-packaging plants and the pharmaceutical industry, the study's leader, Dr Dick Menzies of the Montréal Chest Institute, said:

“Sick building syndrome has often been blamed for irritation of the eyes, throat and nose as well as respiratory illnesses such as asthma. Symptoms also include headaches, fatigue and problems concentrating. By reducing microbial contamination McGill researchers hoped to see a corresponding reduction in the levels of work-related illness.”

After studying the effects of UVGI in three Montreal offices over a period of 48 weeks, the researchers found it had a “substantial effect in reducing reported work-related illnesses,” Menzies said.

A total of 771 employees from three different public and private buildings in Montreal were involved in the double-blind study costing close to US\$250,000, starting in 2001. The UV lamps with parabolic reflectors were turned on for four weeks, then turned off for 12 weeks. The cycle was repeated three times for a year. The use of the UV purifiers resulted in a 99% reduction in the concentration of bacteria on irradiated surfaces within the ventilation systems. Temperature, humidity and ozone levels were unaffected.

“Ultraviolet purifiers use specific UV wavelengths to destroy biological and chemical contaminants in the air-stream and on the air conditioning coil. This study illustrates very well how UV light can destroy microbial contaminants. Using proprietary technology, the purifiers are able to deliver a high concentration of UV intensity to the air conditioning coil virtually eliminating and preventing any future growth.” said Dr Normand Brais, President of Sanuvox Technologies, Inc., manufacturers of the UV purifiers used in the study.

Wladyslaw Jan Kowalski, an architectural engineer at Pennsylvania State University’s Indoor Environment Center, told The Associated Press that the study may be a landmark in proving the technique could be cost-effective in commercial office buildings.

Dr Kowalski, who was not involved with the research, also said the approach could be useful in the broader effort to combat contagious diseases such as flu, Severe acute respiratory syndrome (SARS), tuberculosis and cold viruses.

“Theoretically, if a large number of schools, office buildings and residences were modified, a number of airborne respiratory diseases could be eradicated by interrupting the transmission cycle,” he said. *“Reducing the transmission rate sufficiently would halt epidemics in their path.”*

Principles of UV Air Purification

Any biological contaminant can be destroyed with UV-C light, it is the variables that influence the kill factor.

Two factors in achieving a high kill are:

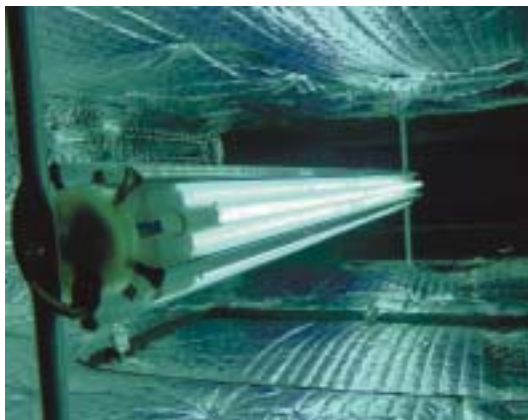
- The intensity of the UV source – the more powerful the source, the more UV energy that can be delivered.
- The length of time that the contaminant is exposed to the UV light – the more time the contaminant is in contact with the UV light, the higher the UV dosage it receives, the greater the kill.

There are two categories of UV purification:

- UV object purification; and
- UV air purification.

UV object purifiers use UV lamps to bask an object with UV energy, destroying and preventing biological growth. An example of an object purifier is treating an air-conditioning coil. The UV lamps will shine on the coil indefinitely, resulting in prolonged exposure to UV, which will prevent microbial growth.

Figure 1: UV Air Purification System by Sanuvox Technologies, Inc.



UV air purification is completely different than UV object purification. Where the object is not moving, it is possible to have UV lamps installed to shine on the object for extended amounts of time. For treating the moving air, there are only milliseconds to deliver the appropriate UV intensity to the contaminant in the moving air. Where the object (coil) is not moving, time is not a variable in achieving a kill but, because in air purification the contaminant is moving, it is essential that the UV intensity be powerful enough to delivery enough intensity to destroy the contaminant.

“Sanuvox has specialized in providing UV solutions for destroying biological and chemical contaminants for over 8 years. The UV Bio-Wall was first introduced as a solution to treat 100% of the air in the entire duct at one time. In October 2001, designs began on an ultraviolet air purifier that would treat the entire duct in order to protect the HVAC system from bio-terrorism. Since the threat of bio-terrorism has subsided, the Bio-Wall has been used in applications ranging from proactive measures in protecting the HVAC system from serious biological contaminants, to solving minor LAQ problems, to applications that

About Sanuvox Technologies

Sanuvox Technologies, Inc. is a leading manufacturer of UV air purifiers and UV coil cleaners. Sanuvox manufactures UV air purifiers for residential, commercial and industrial applications. The Sanuvox line consists of germicidal, UV-C and UV-V purifiers, high-efficiency particulate air/filter/UV-C/UV-V units as well as germicidal coil cleaners. Sanuvox is committed to offering a full line-engineered air purifiers and coil cleaners to solve the problems associated with indoor air quality.

require a high degree of biological destruction. One such application is protecting the facility as well as the HVAC system from mould,” said Dr Normand Brais, President of Sanuvox Technologies, Inc. ■

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