Treat Your Building as a Patient: Environmental Reduction of Bacteria Through Continuous Visible Light Disinfection
What is Indigo-Clean™?

• An overhead light fixture which continuously and safely disinfects the environment using visible light

**White Disinfection Mode = Ambient White Light + Disinfection**

**Indigo Disinfection Mode = Increased Disinfection Only**
What is Visible Light Disinfection?

Visible light spectrum showing the active element in Indigo-Clean™

405 nanometers: Peak germicidal activity via photoexcitation of porphyrin molecules
How Does Indigo-Clean Work?

1. Continuous, automatic, safe system creates hostile environment for bacteria

2. Environment creates Reactive Oxygen Species within bacteria causing inactivation

3. Pathogen inactivation breaks the environmental chain of infection

4. Measured bacterial reduction*

Bringing Innovation to Lighting and Healthcare

- History of disinfection science dating back to Joseph Lister
- Lengthy investment in visible light disinfection technology (10+ years)
- Academic acceptance of technology
- Prototypes and clinical trials

- 50 years of lighting challenging environments
- Experience in healthcare lighting
- Knowledge of infection prevention
- Listings & certifications
- Clinical Evaluation experience
History of Academic Research & Investment in Visible Light Disinfection

Research Timeline

More than 30 refereed publications and proceedings since 2008

Visible Light Disinfection Commercially Available
Potential Healthcare Applications

- Sterile Processing
- Waiting Areas
- Patient Rooms
- Wound Care Clinics
- Oncology
- OR
- Bone Marrow Transplant
- Triage/Trauma
Why Indigo-Clean in the OR?

- Medically Relevant
- Limited Alternatives
- Product Effectiveness
- High Occupancy
Improving Environmental Hygiene
**MDROs Persist in the Environment**

- *Clostridium difficile*: >5 months to years
- Methicillin resistant *Staph. aureus (MRSA)*: >12 months
- MDR – Gram negative (e.g. *Acinetobacter*): >30 months
- Vancomycin Resistant Enterococci (VRE): >46 months
- Norovirus: >2 weeks

Adapted from Kramer et. al. BMC Infect Dis 2006;6:130
Bacterial Reservoirs Exist in the OR

- Top 5 High Touch Areas
  - Anesthesia Computer Mouse
  - OR Bed
  - Nurse Computer Mouse
  - OR Door
  - Anesthesia Medical Cart

- Top 5 Growth Areas
  - Nurse Computer Keyboard
  - Anesthesia Computer Mouse
  - OR Push Plate
  - Anesthesia Medical Cart Drawer
  - OR Bed

Link, T., et al. “Determining high touch areas in the operating room with levels of contamination”, AJIC 2016; Article in Press
Cleaning Can Be Improved in Many Operating Rooms

Despite the best efforts of environmental services...

...75% of environmental surfaces remain contaminated even after terminal cleaning\(^1\)...

...and 17% of OR surfaces contained bacterial pathogens\(^2\)

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\(^2\)Munoz-Price LS, et. al. “Decreasing operating room environmental pathogen contamination through improved cleaning practices”, *Infect Control Hosp Epidemiol* 2012;33:897-904
No Touch Disinfection Technology

• **Continuous**
  - Air Filters
  - UV/Plasma air handlers
  - Copper surfaces
  - Environmental sprays
  - Visible Light

• **Episodic**
  - UV Devices
  - Chemical Vapor
Episodic vs. Continuous or (Apples vs. Oranges)

**Episodic (UV)**
- Useful in outbreak or terminal cleaning applications
- Often takes the room out of service
- Potential safety issues
- Potential compliance issues

**Continuous (Visible)**
- Useful in areas which must remain operational 24/7
  - Capacity Limitations
  - Quick Turnover
- Cleans even when people aren’t in the room
- Designed to be safe for patients and staff
- Eliminates compliance issues
Episodic vs. Continuous Disinfection
Episodic vs. Continuous - Definition

Continuous = Total Bacteria Killed (High-Level Continuous-Ideal, but not practical)

Episodic = Total Bacteria Killed (Episodic- Practical implementation of ideal solution)

Low-Level Continuous = Total Bacteria Killed (Low-Level Continuous-Compliment to Episodic)

“Continuous Disinfection Fills the Gaps”
Effects of Disinfection Upon Bacteria Levels

- Episodic Disinfection Applied
- Continuous Disinfection Applied
- Average Bacteria Level (w/Episodic Disinfection Only)
- Average Bacteria Level (w/Episodic + Continuous Disinfection)
- Net Gain from Continuous Disinfection
- "Log X Kill"
- Regrowth
Which is Better?

Episodic VS. Continuous

Episodic + Continuous
Clinical Implementation of Indigo-Clean
Clinical Implementation of Indigo-Clean™

- Overhead light fixtures which *continuously* and *safely* disinfect the environment using visible light.

*White Disinfection Mode = Ambient White Light + Disinfection*

*Indigo Disinfection Mode = Increased Disinfection Only*
Indigo-Clean In An Operating Room

Airborne Pathogens

Variety of Surfaces

Hard to Reach
Current Evaluation Data for Indigo-Clean
ESKAPE Pathogens

- Enterococcus faecalis
- Staphylococcal Aureus* (including MRSA)¹
- Klebsiella pneumoniae
- Acinetobacter baumannii
- Pseudomonas aeruginosa
- Enterobacter species

* = Demonstrated clinical susceptibility to presumptive S. Aureus & MRSA


Gram-Positive Bacteria
- Clostridium perfringens
- Staphylococcus epidermidis (CONS)
- Staphylococcus hyicus (CONS)
- Streptococcus pyogenes
- Listeria monocytogenes
- Mycobacterium terrae
- Corynebacterium striatum

Gram-Negative Bacteria
- Proteus vulgaris
- Escherichia coli (E. coli)
- Campylobacter jejuni
- Salmonella enteritidis
- Shigella sonnei
- Serratia spp

Yeast & Filamentous Fungi
- Aspergillus niger
- Candida albicans
- Saccharomyces cerevisiae

Bacterial Endospores
- Clostridium difficile
- Bacillus cereus

Continuous Environmental Disinfection

Demonstrated Laboratory Susceptibility to Visible Light Disinfection
Significant reduction of total bacterial contamination on surfaces around the room (2-day use)

76% reduction

Lights Off

Lights On

Bacterial reduction on a range of surfaces before and after use of the Visible Light Disinfection

All reductions in bacterial contamination were achieved over and above standard cleaning and infection control practices

Additional Publication Data

HINS-light Publication List (July 2012)

Scientific Journal Publications on the antimicrobial effects of 405 nm-light:


For a full list of available publications, please visit:

http://www.indigo-clean.com/resources-white-papers
Froedtert & The Medical College of Wisconsin Froedtert Hospital

• GI Diagnostic Waiting Area
  • Easier to show a reduction due to high amount of bacteria
  • Proximity to procedure rooms
  • Approximately 450 ft.$^2$ (Equivalent to small OR)
  • Results consistent with previously published patient room results
  • Additional studies underway
Clinical Results for Indigo-Clean™

• Inactivation of S. aureus in Waiting Room

“In Phase 2 of the trial, where the lighting deployment was optimized across the room, we were able to improve the bacterial reduction to more than 70%.”

- Dr. Nathan Ledeboer, Associate Professor of Pathology, Medical College of Wisconsin
Clinical Success at MCW/Froedtert
Clinical and Commercial Success!

- State-of-the-art facilities in Las Vegas and other unannounced locations
- Henderson Hospital-Universal Health Services Inc.

“Even the lights will get into the safety prevention with special indigo lighting built into the ceilings that will kill bacteria”

For infection prevention, silver ion-infused countertops will be used in patient care areas to help reduce bacteria; silver ion thread will be used for cubicle curtains; antimicrobial coating will be on all door handles. To keep the noise down, there will be high-end, superior acoustics in patient rooms and nursing stations that include areas for group discussions between physicians, case managers and pharmacists. The hospital has also installed special acoustic tile. It all comes down to patient satisfaction, Kaufmann said.
Your Invitation to Join the Clinical Partners Program