

Photo-Catalysis



Photo-catalysis

Photo = light

Catalysis= degradation

Photo-catalysis = degradation of biological substances by light

Photosynthesis = building of biological substances by light



Catalysis

A CATALYST Facilitates A REACTION WITHOUT BEING CONSUMED BY IT.

Photo-catalysis is a natural phenomena. Such as fire, wind, wáter.

Titanium dioxide is the best catalyst for the dismanteling of biological substances by light. Other metals and metal oxides have been used AS PHOTOCATALYSITS. HOWEVER, PURE TATANIUM DIOXIDE HAS PROVEN TO BE THE MOST EFFECTIVE PHOTO-CATALYST, AND AT THIS TIME, THE MOST ECONOMICAL.



Challenges titanium dioxide nano crystals

The crystals need to be exposed to the light and need to come into physical contact with the virus , bacteria, or gas molecule that needs to be degraded.
If the crystals are covered with a “glue” or whatever substance to hold the crystals together, most of the catalytic power will be lost.



Experiments with photo-catalysis

The properties of titanium dioxide as a photocatalyst has interested scientists since the 1920

In the 1960th. An American scientist from Texas and several Japanese scientists resurrected titanium dioxide as a photocatalyst.

In Japan, photocatalysis spread like wildfire, and photochemical products became a very important industry.

In the US, FN nano is being pushed to the front lines by COVID-19.



Photocatalytic disinfection

All airborne viruses
All airborne bacteria
Mold and mold spores
Airborne allergens, dust particles, mite excrements
Pollen
Terpines and other volatic organic compounds

Greenhouse gases inactivation

Greenhouse gases are reduced to their basic components
or less harmful substances.

Methane to carbon dioxide and water

Formaldehyde

Benzene

Carbon monoxide

NO_x



Places that need FN®NANO photocatalytic coatings for disinfection

Hospitals
Nursing homes
Schools
Airports
Gyms
Restaurants
homes



Need for FN®NANO photocatalytic coatings

farms

Industry

Oil and gas industries

Churches

All public places



Are the FN®NANO coatings toxic?

All the ingredients of the coatings are natural minerals and all except titanium dioxide are necessary ingredients of the human DIET.

TITANIUM DIOXIDE IS A FOOD ADDITIVE APPROVED BY THE FDA.

THE COATINGS ARE NOT APPROVED BY THE FDA BECAUSE THE FDA DOES NOT REGULATE COATINGS FOR CEILINGS AND WALLS.



Are the FN®NANO coatings approved by the EPA?

The environmental protection agency (EPA) regulates products that have the potential of adversely impacting the environment, which means, products that work through a chemical reaction.

Photocatalysis is a physical reaction, just like a hot plate. No pollutants are discharged into the environment.

Consequently, the fn coatings are not regulated by the epa
The fn coating do not discharge any substance into the environment









Every Breath You Take:

Innovative Air Quality Design



An American Institute of Architects (AIA) Continuing Education Program

Credit(s) earned upon completion of this course will be reported to AIA CES for AIA members. Certificates of Completion for both AIA members and non-AIA members are available upon request.

This course is registered with AIA CES for continuing professional education. As such, it does not include content that may be deemed or construed to be an approval or endorsement by the AIA of any material of construction or any method or manner of handling, using, distributing, or dealing in any material or product.

You must complete the quiz upon completion of this course with an 80% or higher to receive credit.



Objectives

Upon completion of this course, the design professional will be able to:

- **Discuss** the LEED v4 Indoor Environmental Quality (EQ) category and common indoor air quality issues that affect the health of building occupants.
- **Describe** how FN[®] NANO photocatalytic coatings can help protect the health and comfort of building occupants.
- **Review** how FN[®] NANO Photocatalytic Coatings main component, Titanium dioxide (TiO₂) destroys VOCs, allergies, odors, mold, bacteria, and viruses in buildings indoors and outdoors.
- **Explain** how FN[®] NANO photocatalytic coatings can clean interior and exterior building surfaces and help combat air pollution.



Air Pollution Kills 6 Million People Annually



Indoor Air Quality Problems

- Americans spend 90% of their time indoors
- EPA studies indicate indoor environments can have higher level of pollution than outdoor environment
- Poor indoor air quality may cost the CANADA several billion dollars annually

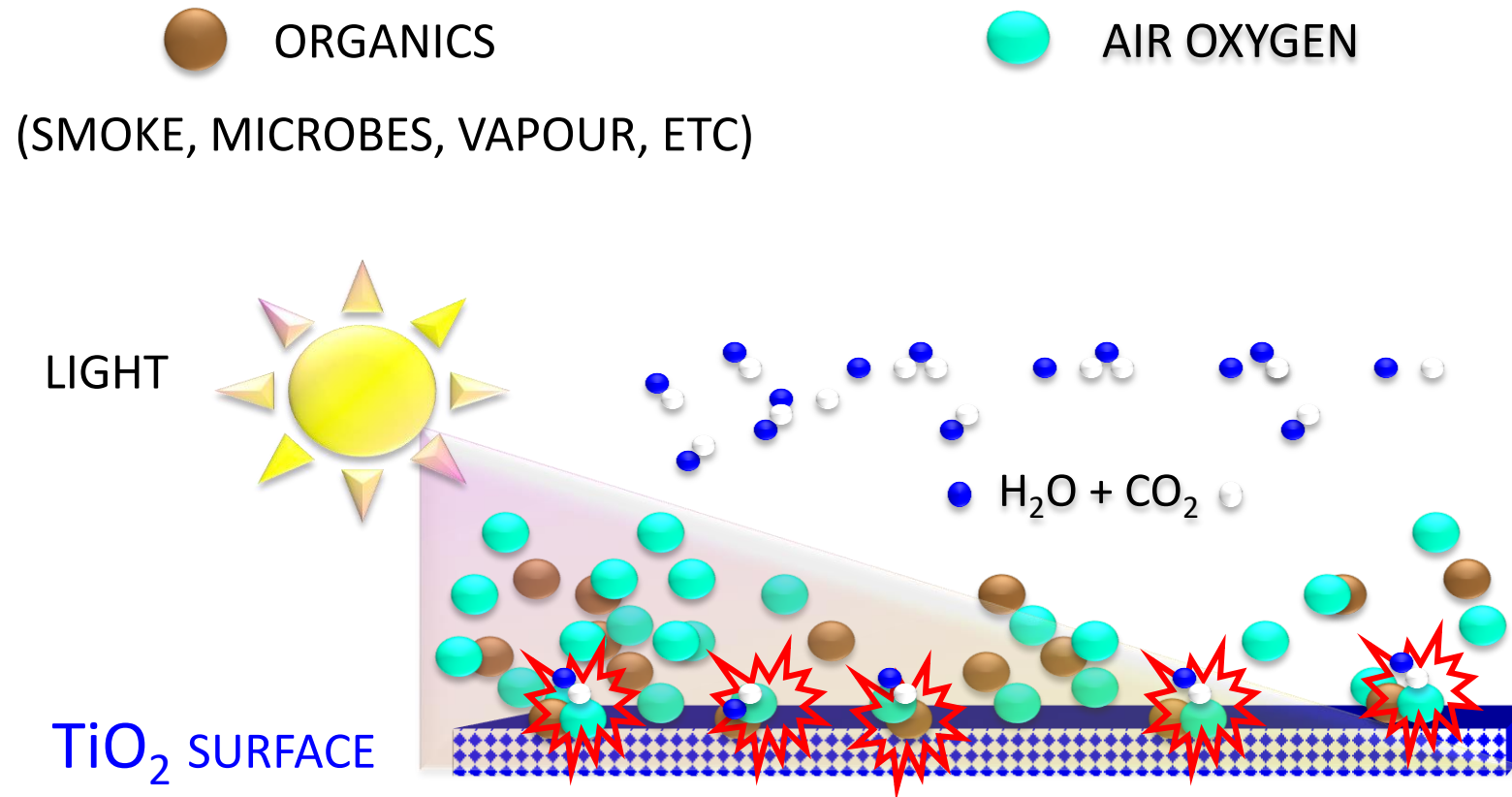




Sunlight is the best disinfectant



Photocatalysis and Building Materials

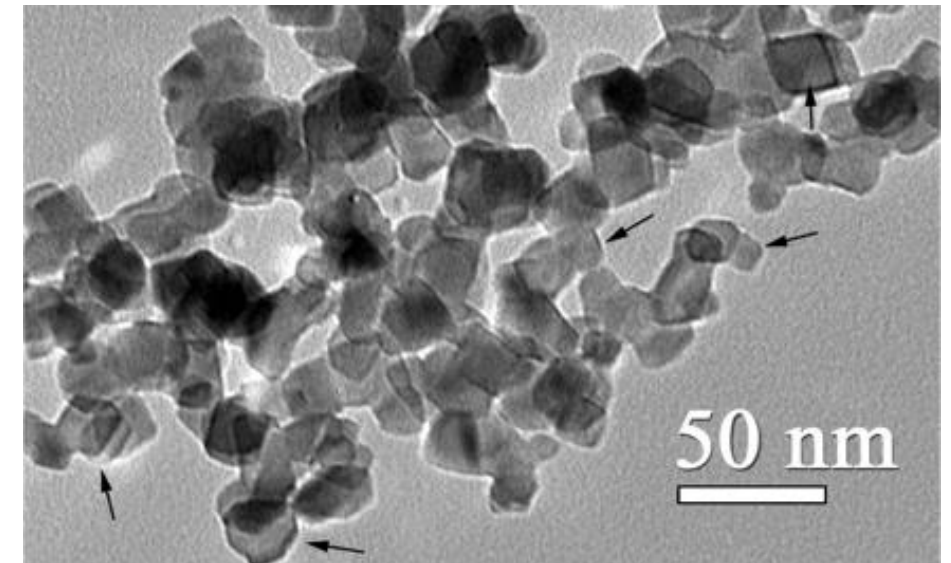


Titanium dioxide



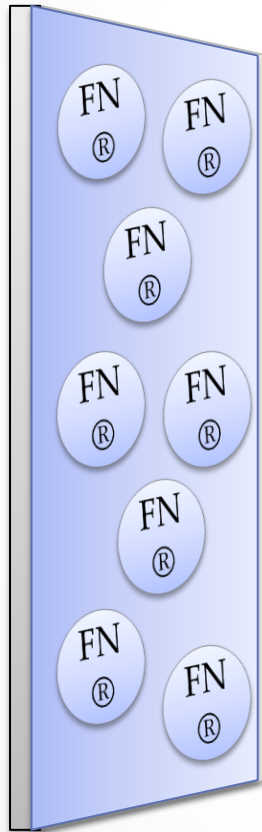
Titanium dioxide nanoparticles

- Titanium dioxide nanoparticles have diameter less than 100 nm
- Titanium dioxide and its photocatalytic sterilizing properties also make it useful as an additive in construction materials
- Titanium dioxide can be considered a "legacy" nanomaterial



FN® Nano Coatings

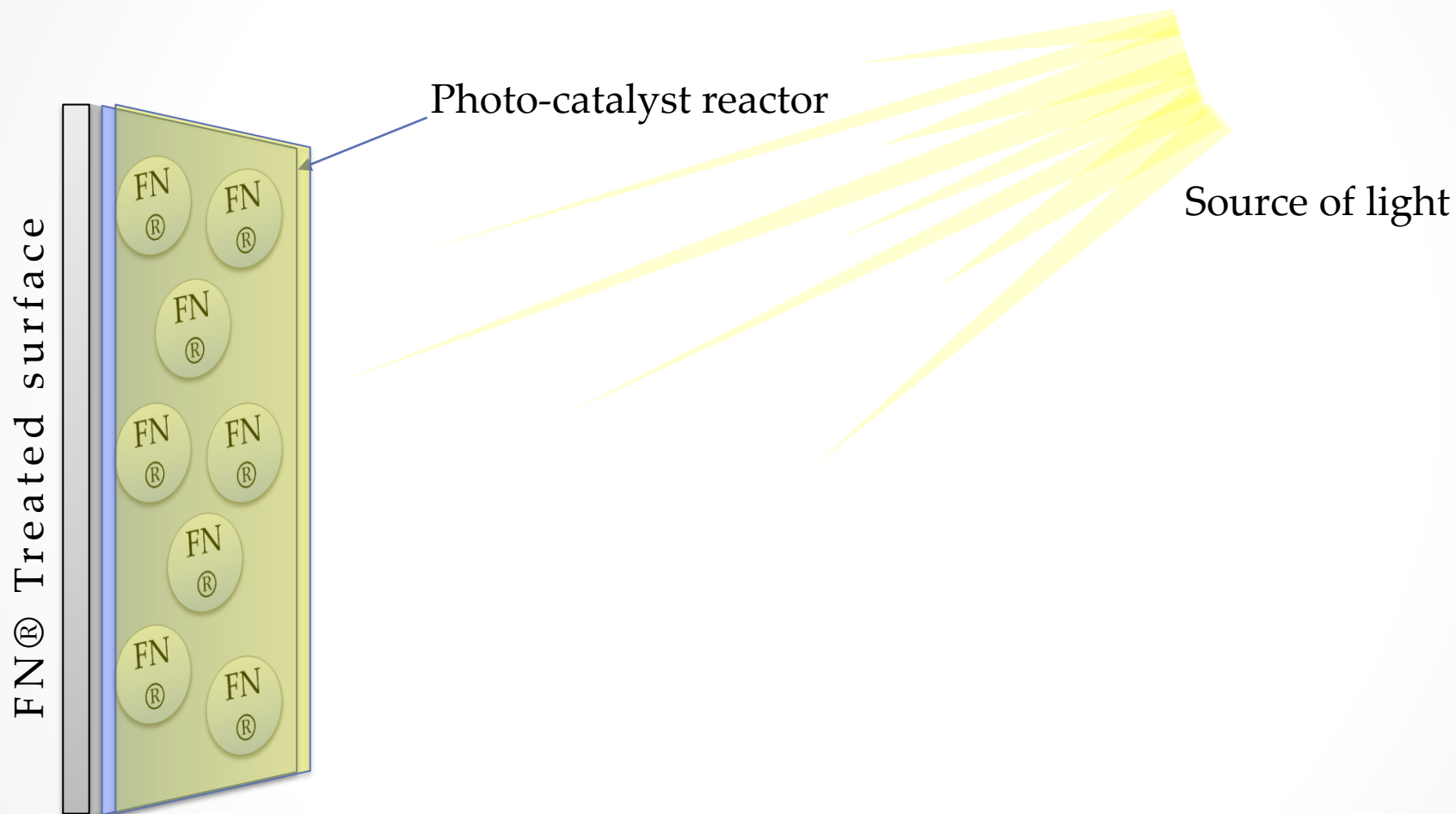
How does it work?





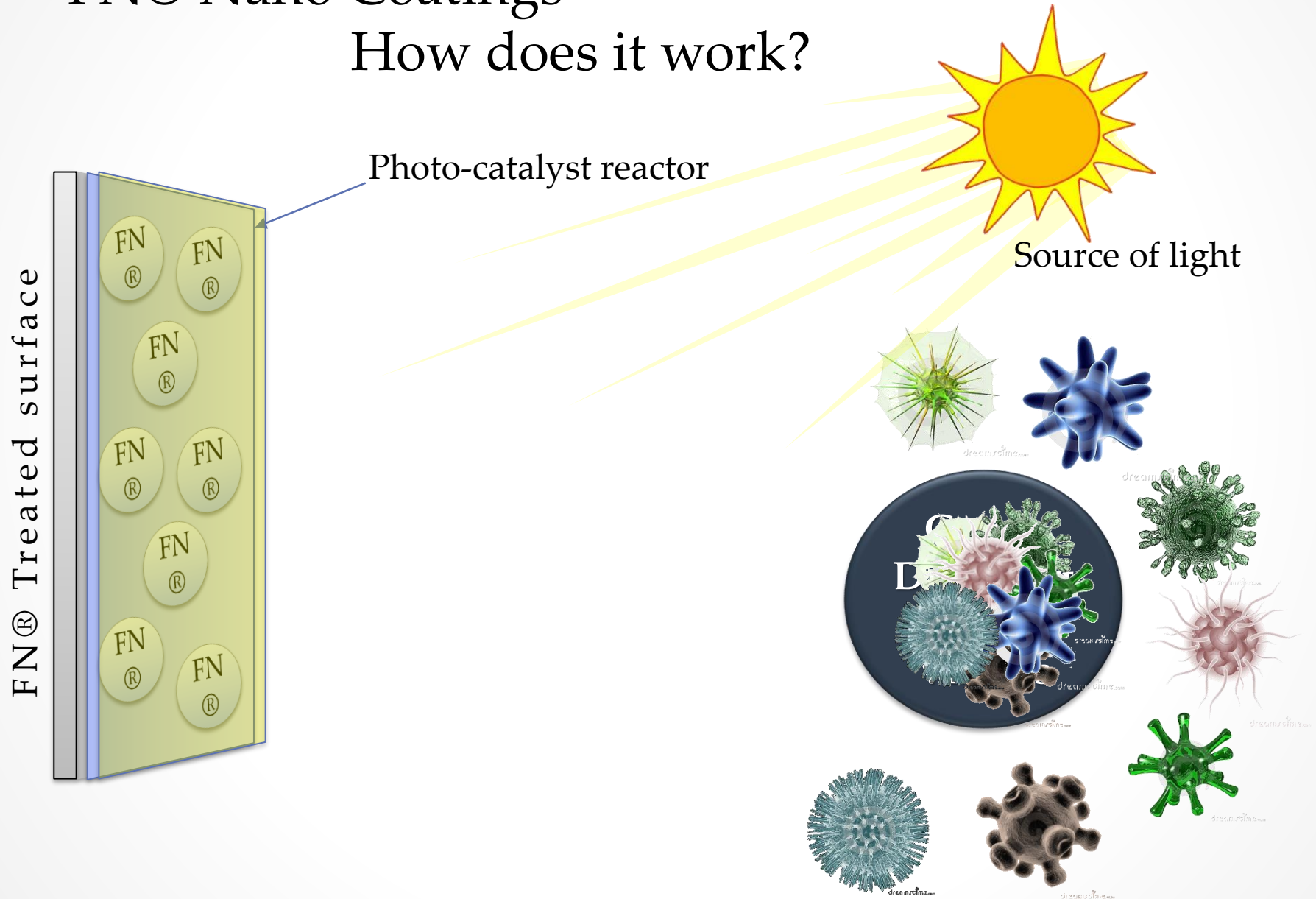
FN® Nano Coatings

How does it work?



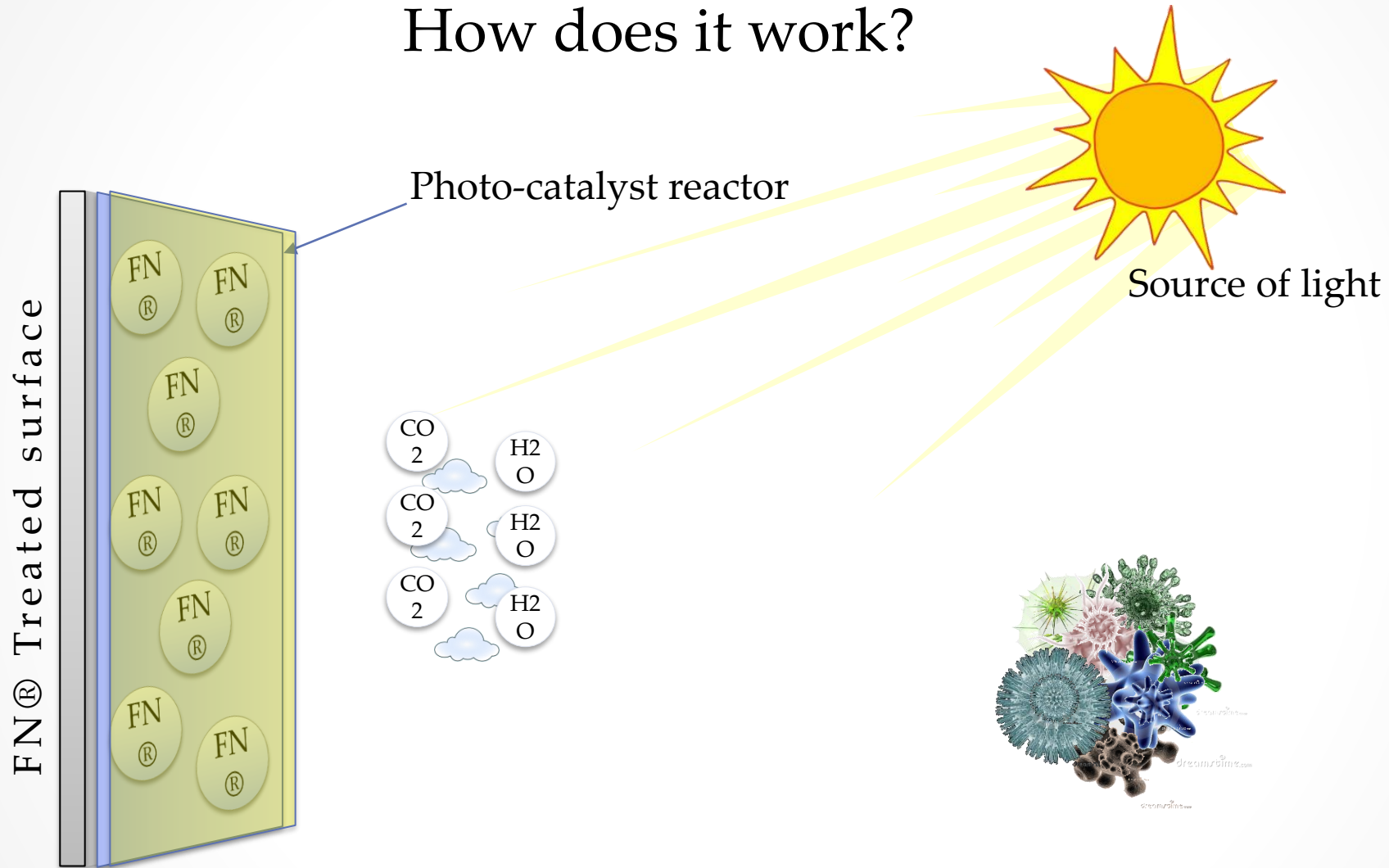
FN® Nano Coatings

How does it work?



FN® Nano Coatings

How does it work?



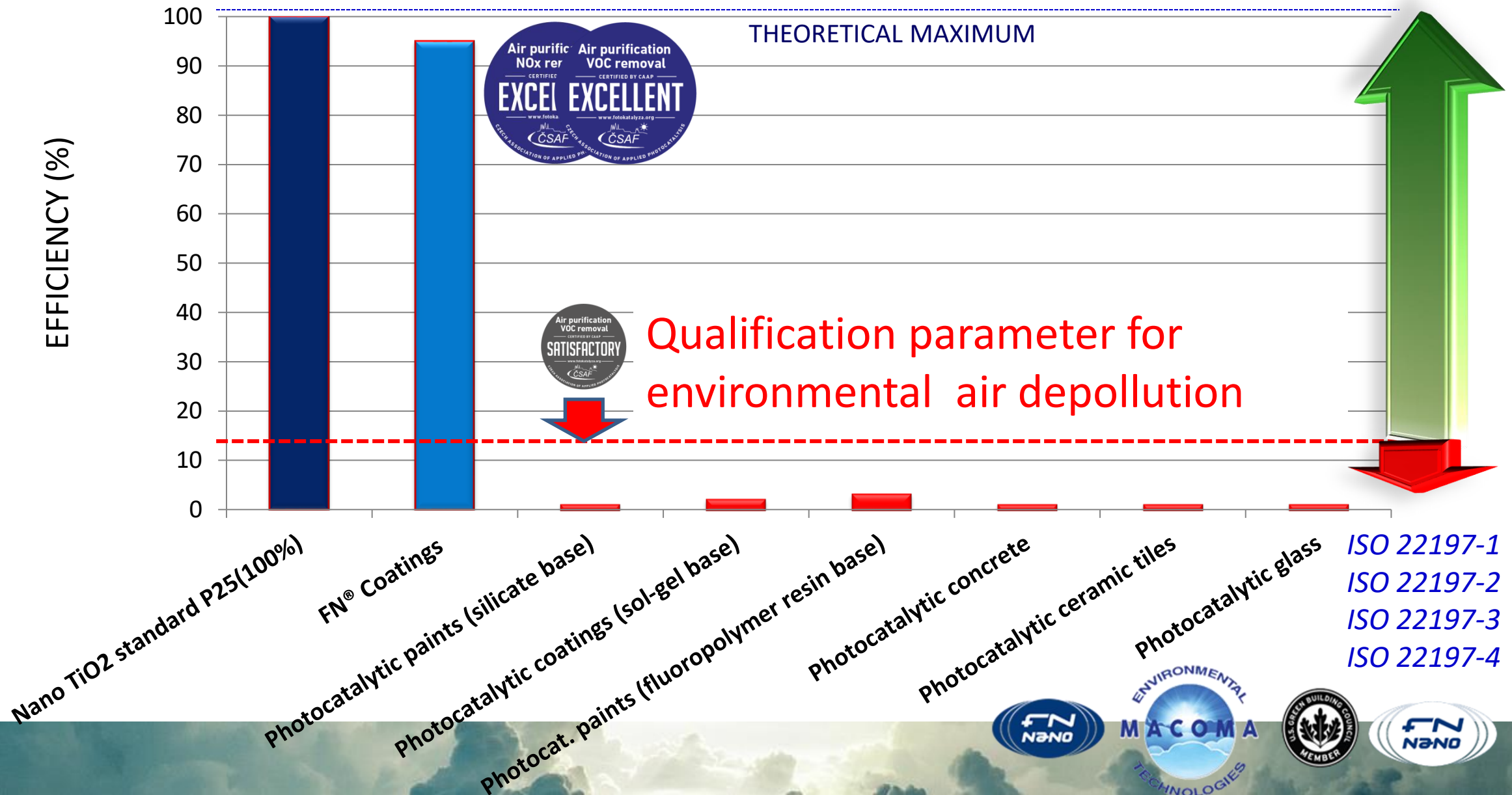
Global Warming Potential and Atmospheric Lifetime for Major Greenhouse Gases

For example, **sulphur hexafluoride is used to fill tennis balls**. The table shows that a release on **1 kg** of this gas is equivalent to 22,800 kg or **22.8 tonnes** of CO₂. Therefore, **releasing ONE KILOGRAM** of sulphur hexafluoride is about **equivalent to driving 5 cars for a year!** (2)

Greenhouse Gas	Formula	100-year GWP (AR4)
Carbon dioxide	CO ₂	1
Methane	CH ₄	25
Nitrous oxide	N ₂ O	298
Sulphur hexafluoride	SF ₆	22,800
Hydrofluorocarbon-23	CHF ₃	14,800
Hydrofluorocarbon-32	CH ₂ F ₂	675
Perfluoromethane	CF ₄	7,390
Perfluoroethane	C ₂ F ₆	12,200
Perfluoropropane	C ₃ F ₈	8,830
Perfluorobutane	C ₄ F ₁₀	8,860

Comparison – efficiency of photocatalytic products (%)

FN[®] efficiency – almost as high as a pure photocatalyst



Effects of weathering photocatalytic performance

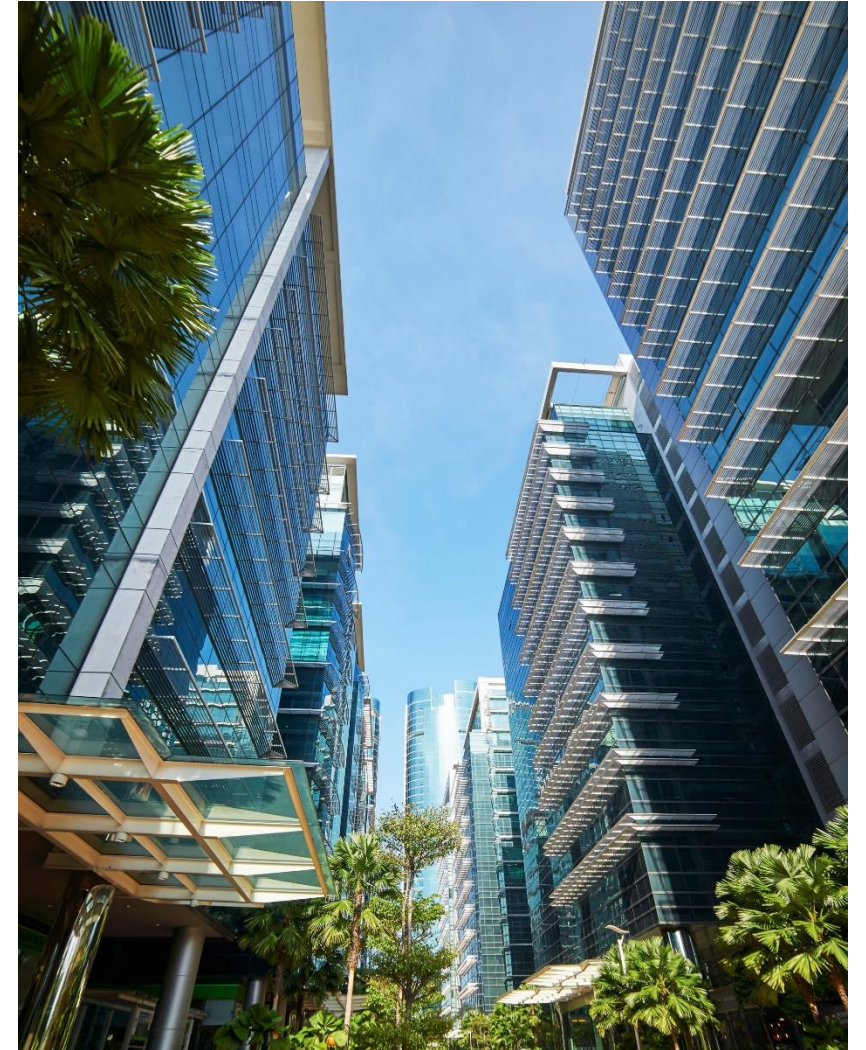








LEED v4 Building Design + Construction





Indoor Environmental Quality (EQ) Category

Buildings with good EQ:

- Protect building occupants
- Enhances productivity
- Decreases absenteeism
- Increases building's value
- Reduces liability





Indoor Environmental Quality (EQ) Category





Low-Emitting Materials Credit

Credit Intent:

“To reduce concentrations of chemical contaminants that can damage air quality, human health, productivity, and the environment.”

Credit Applies To:

New Construction
Core and Shell
Schools
Retail
Data Centers
Hospitality
Healthcare
Warehouses
Distribution Centers





WHY DO WE CARE?

water, water everywhere



Low-Emitting Materials Credit





Low-Emitting Materials Credit

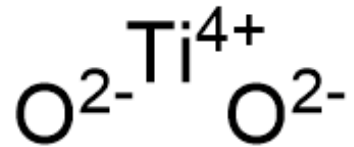
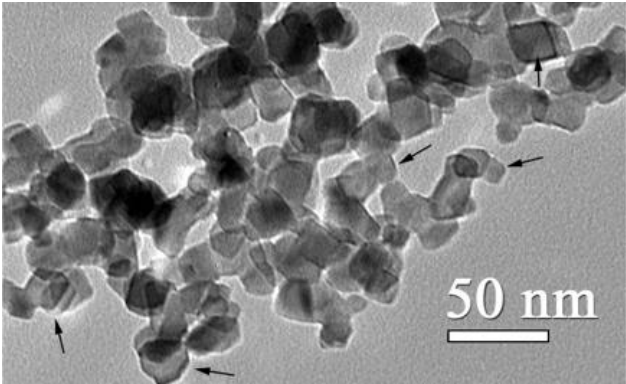
TABLE 1. Thresholds of compliance with emissions and content standards for 7 categories of materials

Category	Threshold	Emissions and content requirements
Interior paints and coatings applied on site	At least 90%, by volume, for emissions; 100% for VOC content	<ul style="list-style-type: none"> General Emissions Evaluation for paints and coatings applied to walls, floors, and ceilings VOC content requirements for wet applied products
Interior adhesives and sealants applied on site (including flooring adhesive)	At least 90%, by volume, for emissions; 100% for VOC content	<ul style="list-style-type: none"> General Emissions Evaluation VOC content requirements for wet applied products
Flooring	100%	General Emissions Evaluation
Composite wood	100% not covered by other categories	Composite Wood Evaluation
Ceilings, walls, thermal, and acoustic insulation	100%	<ul style="list-style-type: none"> General Emissions Evaluation Healthcare, Schools only Additional insulation requirements
Furniture (include in calculations if part of scope of work)	At least 90%, by cost	Furniture Evaluation
Healthcare and Schools Projects only: Exterior applied products	At least 90%, by volume	Exterior Applied Products

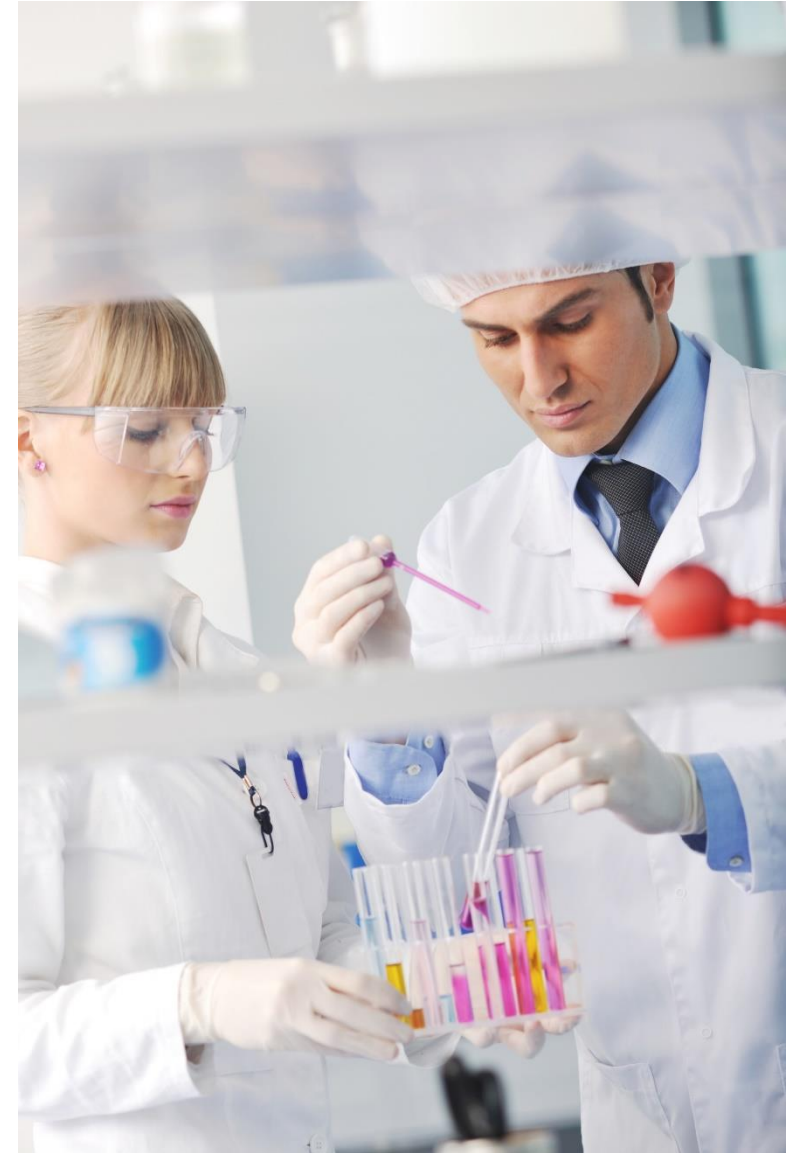




Low-Emitting Materials Credit



titanium dioxide





Low-Emitting Materials Credit





Low-Emitting Materials Credit



Photocatalytic Coatings Passed:

ISO 16000-10

ISO 16000-11

ISO 22197-1

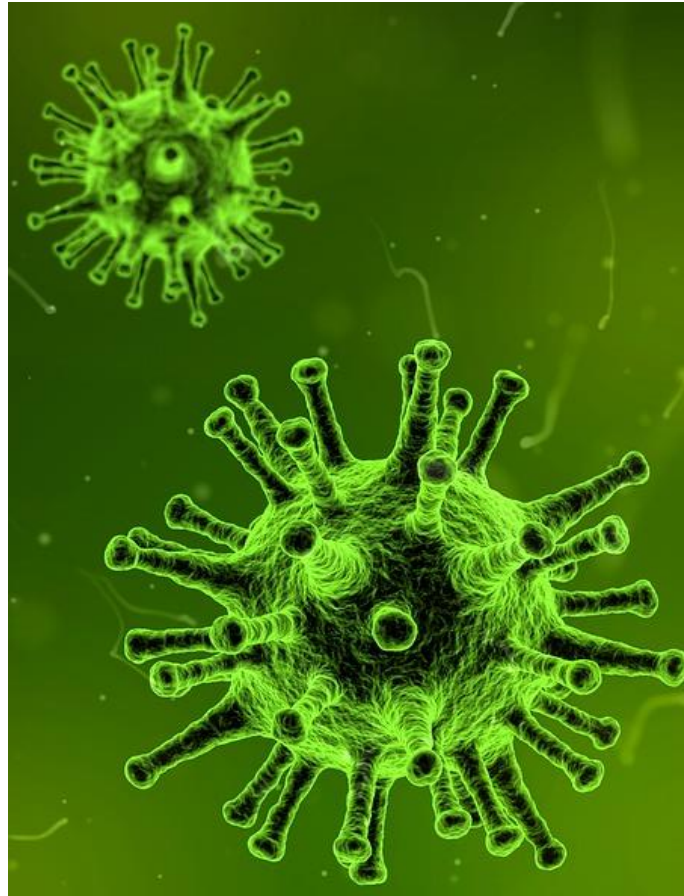
ISO 22197-2

ISO 22197-3

ISO 22197-4



Biological Pollutants



Photocatalytic Coatings Benefits



Photocatalytic Coatings Applications

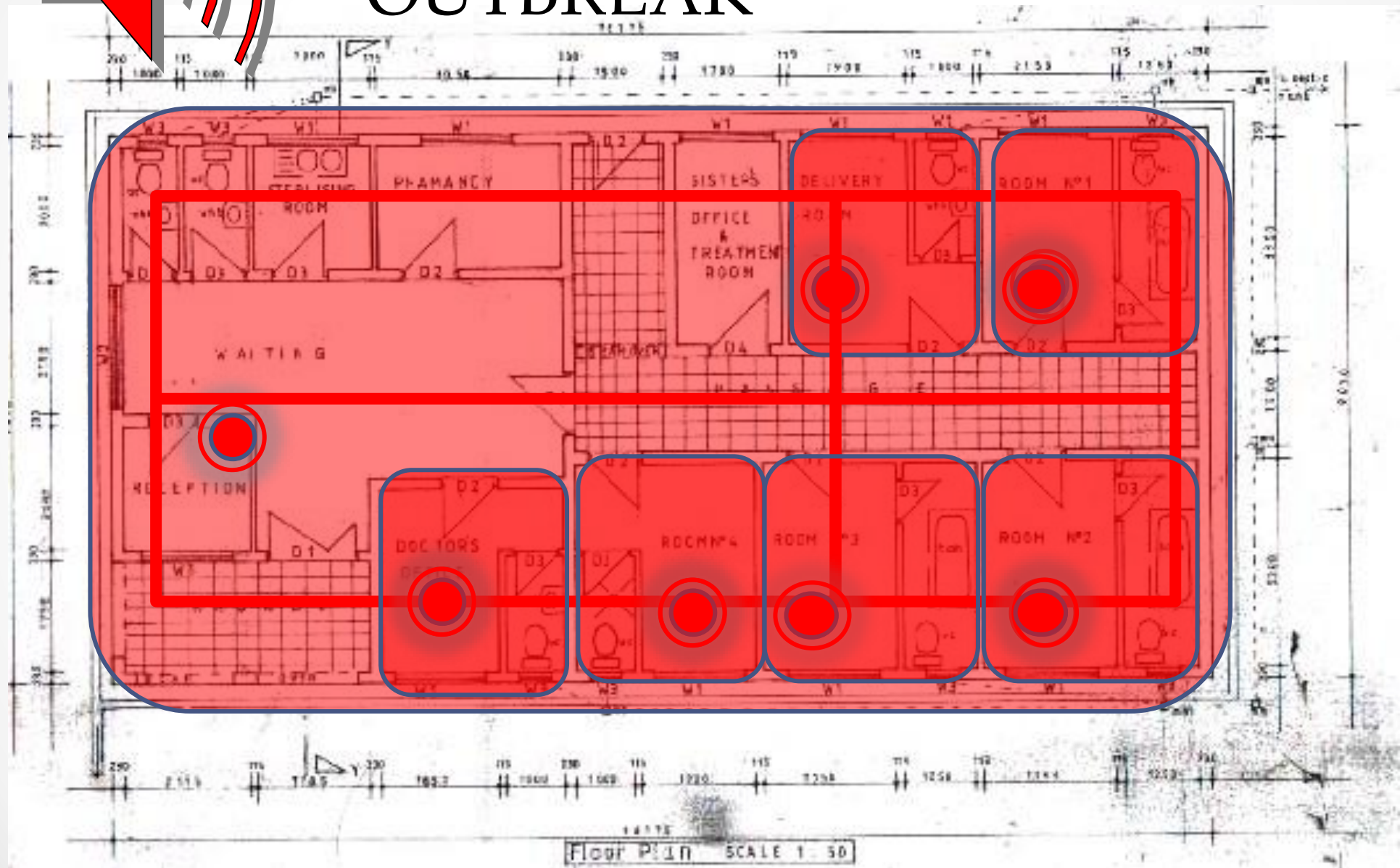


Hospitals





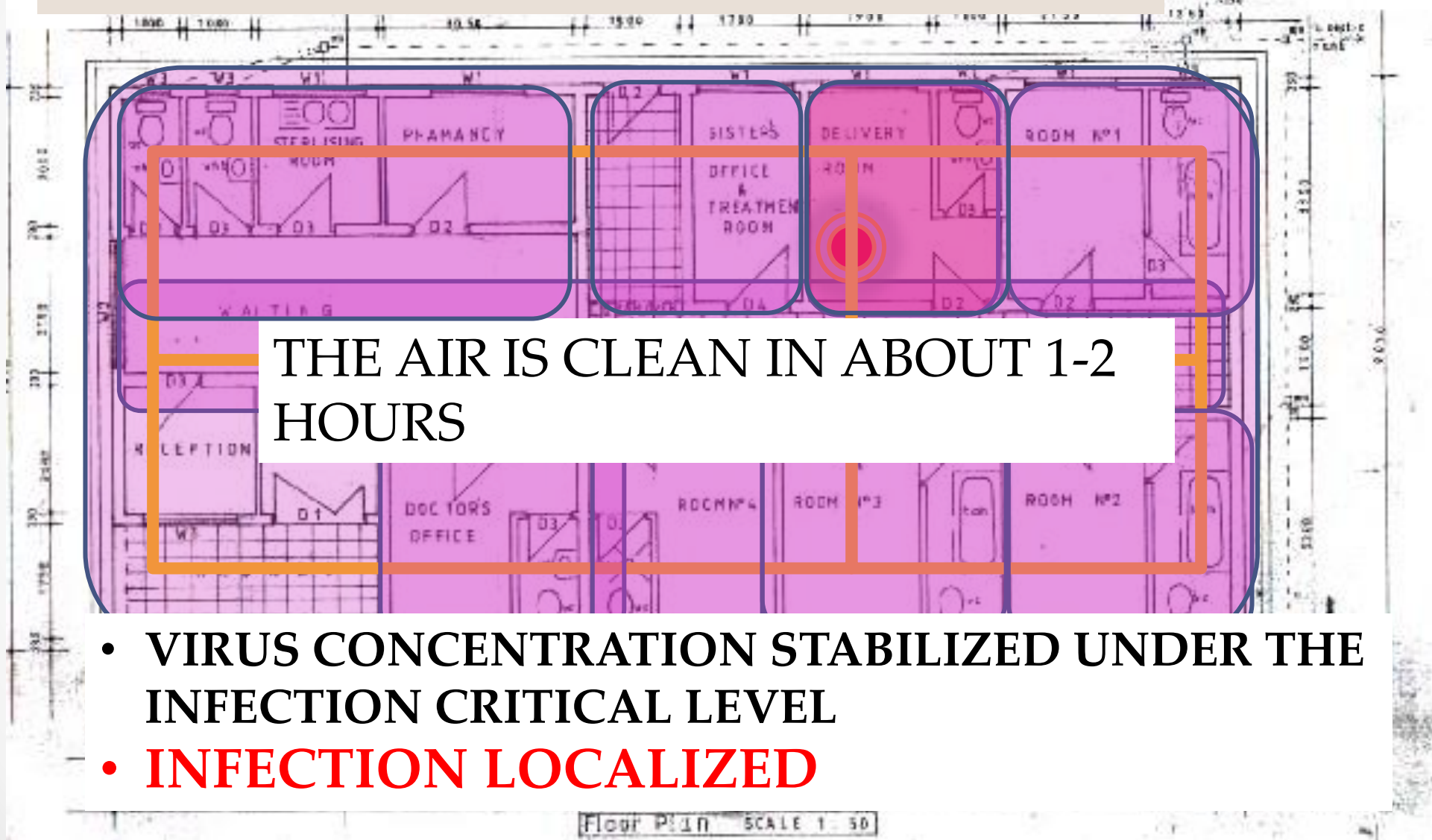
INFECTION OUTBREAK



FN® COATING

INFECTION OUTBREAK CONTROL

SOFT UVA ACTIVATION LIGHTS ON!!!



THE AIR IS CLEAN IN ABOUT 1-2 HOURS

- VIRUS CONCENTRATION STABILIZED UNDER THE INFECTION CRITICAL LEVEL
- **INFECTION LOCALIZED**

Airborne
Viruses

COVID-19

Airborne
Bacteria

PM 2.5

PHOTOCATALYSIS

Benzine

Air Pollution

Greenhouse
Gasses

Formaldehydes



Photocatalytic Coatings Applications



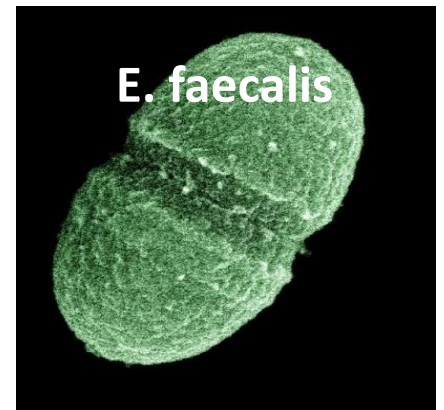
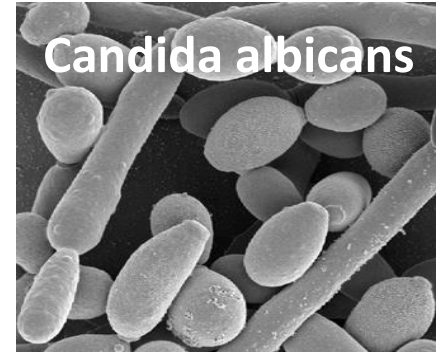
Hospitals



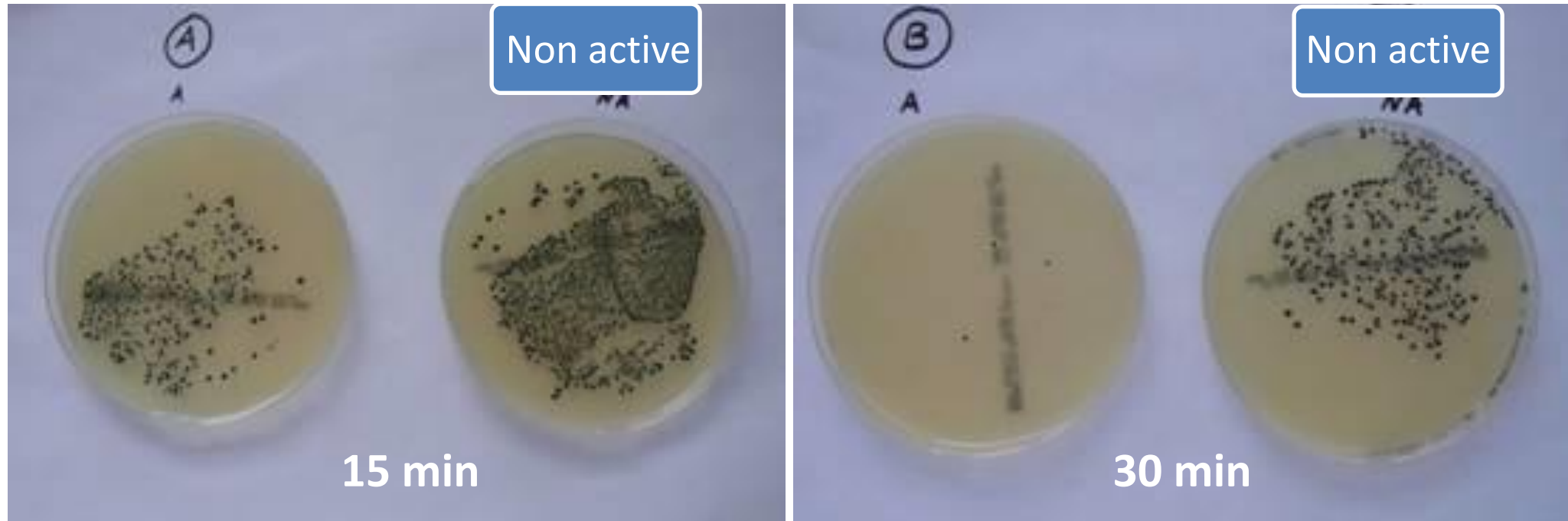
FN-NANO Photocatalytic Coating Applications

Microorganism	UV Exposure time (min)	UV Intensity mW/cm2	START concentration (CFU)	END concentration (CFU)	Reference sample END concentration (CFU)	BACTERIA REDUCTION ON FN2 SURFACE (%)
Bakteriophage E.Coli ΦX 174 (MODEL VIRUS)	60 min	0.05-0.1	0.2 ml 1.00E+06	60	1.00E+06	99.9940%
	60 min	0.05-0.1	1.00E+06	30	1.00E+06	99.9970%
	6 hours	0.05-0.1	1.00E+08	88	1.00E+08	99.9999%
	6 hours	0.05-0.1	1.00E+05	0	1.00E+05	100%
	6 hours	0.05-0.1	1.00E+08	400	1.00E+08	99.9996%
	6 hours	0.05-0.1	1.00E+05	15	1.00E+05	99.9850%
	60 min	0-dark	1.00E+06	1.00E+06	1.00E+06	0%
Candida albicans	120 min	0.05-0.1	0.2 ml 1.00E+06	0	1.00E+06	100%
Candida albicans	120 min	0.05-0.1	1.00E+06	0	1.00E+06	100%
Pseudomonas aeruginosa	120 min	0.05-0.1	0.2 ml 1.00E+06	0	1.00E+06	100%
Pseudomonas aeruginosa	120 min	0.05-0.1	1.00E+06	0	1.00E+06	100%
Enterococcus faecalis 4224	120 min	0.1-0.3	0.3 ml 1.50E+08	767	not countable	99.99949%

Hospitals



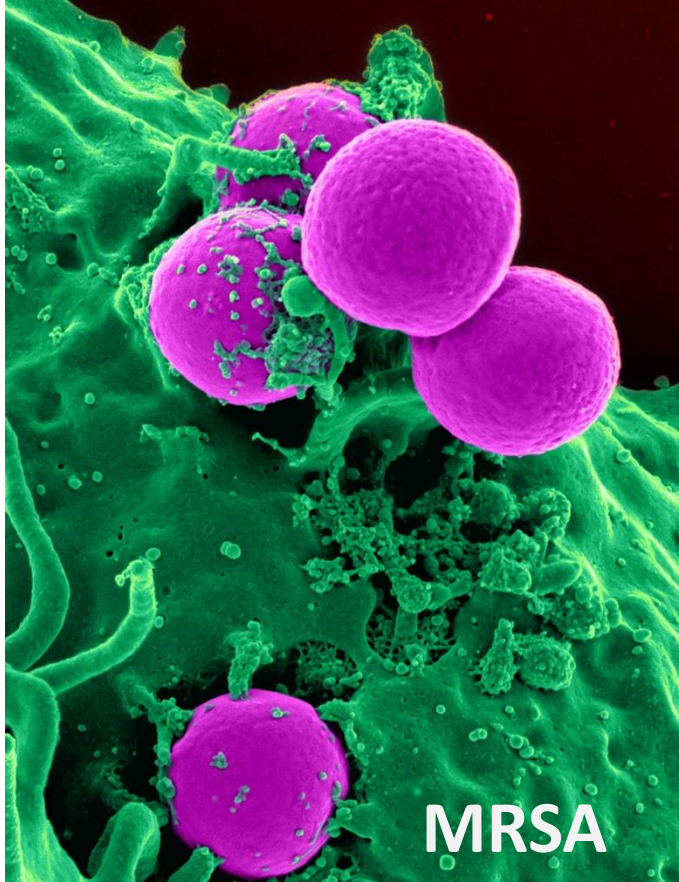
Photocatalytic Coatings Applications



Hospitals



Photocatalytic Coatings Applications



Hospitals

UV Activation Light



Daylight –Main Source of Activation



Photocatalytic Coatings Applications



Hospitals



Photocatalytic Coatings Applications



Hospitals



Photocatalytic Coatings Applications



Hospitals



Photocatalytic Coatings Applications



Schools



Photocatalytic Coatings Applications



Schools



Photocatalytic Coatings Applications

Failure To Prevent Air Quality Problems Can:

- Increase potential for long- and short- term health problems for students and staff.
- Negatively impact student attendance, comfort, and performance.
- Reduce teacher and staff comfort and performance.
- Accelerate deterioration and reduce efficiency of school facilities and equipment.



Schools



Photocatalytic Coatings Applications

Failure To Prevent Air Quality Problems Can:

- Increase potential for school closings or relocation of occupants.
- Strain relationships among school administration, parents, and staff.
- Create negative publicity.
- Impact community trust.
- Create liability problems.



Schools



Photocatalytic Coatings Applications

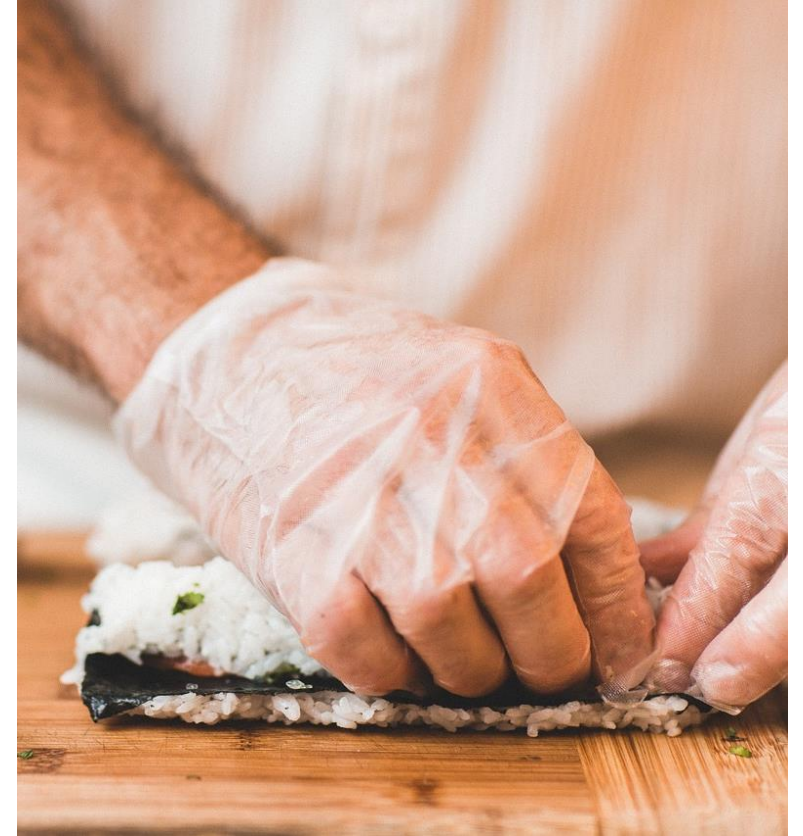


**CENTERS FOR DISEASE
CONTROL AND PREVENTION**

Restaurants



Photocatalytic Coatings Applications



Restaurants / Supermarkets



Photocatalytic Coatings Applications

5 Germs That Cause Illnesses From Food:

- Norovirus
- Salmonella
- Clostridium perfringens
- Campylobacter
- Staphylococcus aureus (Staph)



Restaurants / Supermarkets



Photocatalytic Coatings Applications

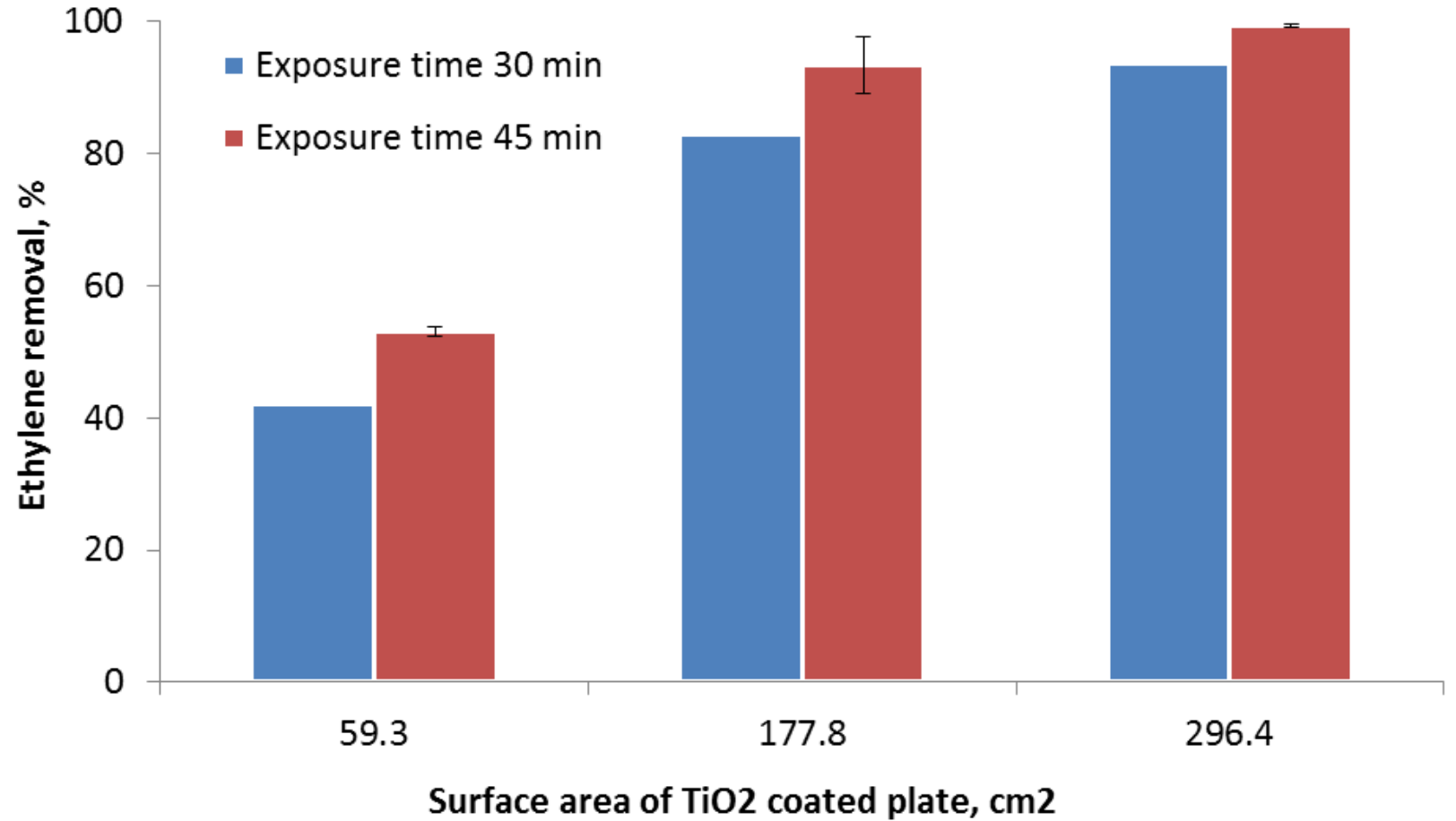


Supermarkets





ETHYLENE=trigger to rotten and die



Supermarkets



Photocatalytic Coatings Applications



Exterior Surfaces



Ecological function:

Objects treated with FN® coatings work as cleaning eco-machines.

SELF- CLEANING, AIR PURIFYING FACADES , NEW STANDARD

1 m² of FN® cleans an average of 3,000,000 m³/y of air from photocatalytically degradable pollutants (NO_x, CO, SO_x, VOCs, benz-a-pyrene and others)



A 10,000 square feet of FN® NANO Building,
Purifies 85,000,000 of square feet of air per day!



Photocatalytic Coatings Applications

Treated

Untreated



Green Algae

Untreated

Treated



Black Algae

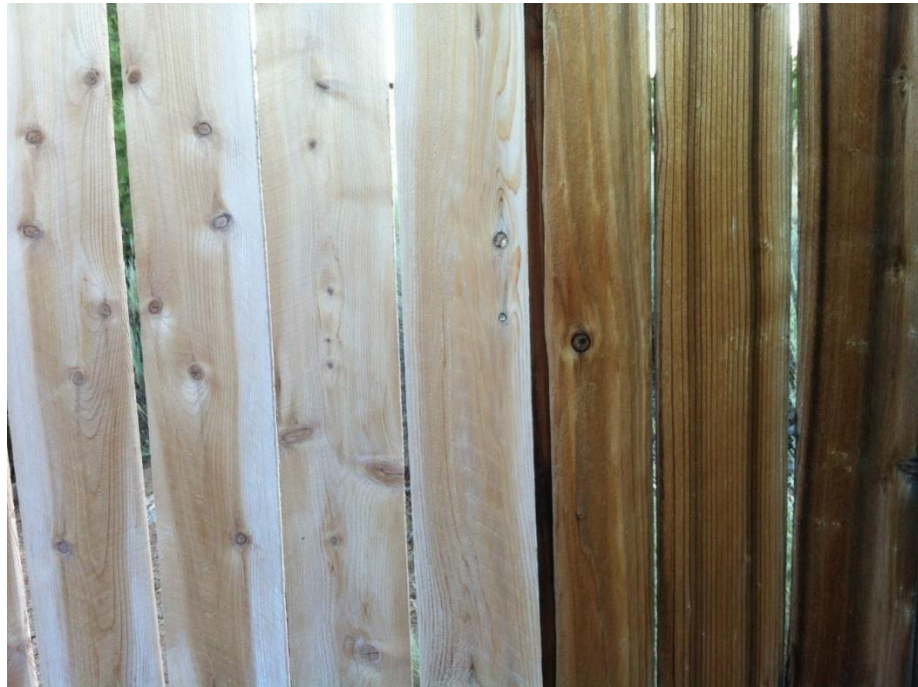
Exterior Surfaces



Photocatalytic Coatings Applications

Treated

Untreated



Untreated



Treated



Exterior Surfaces



Photocatalytic Coatings Applications



Graffiti Protection & Removal



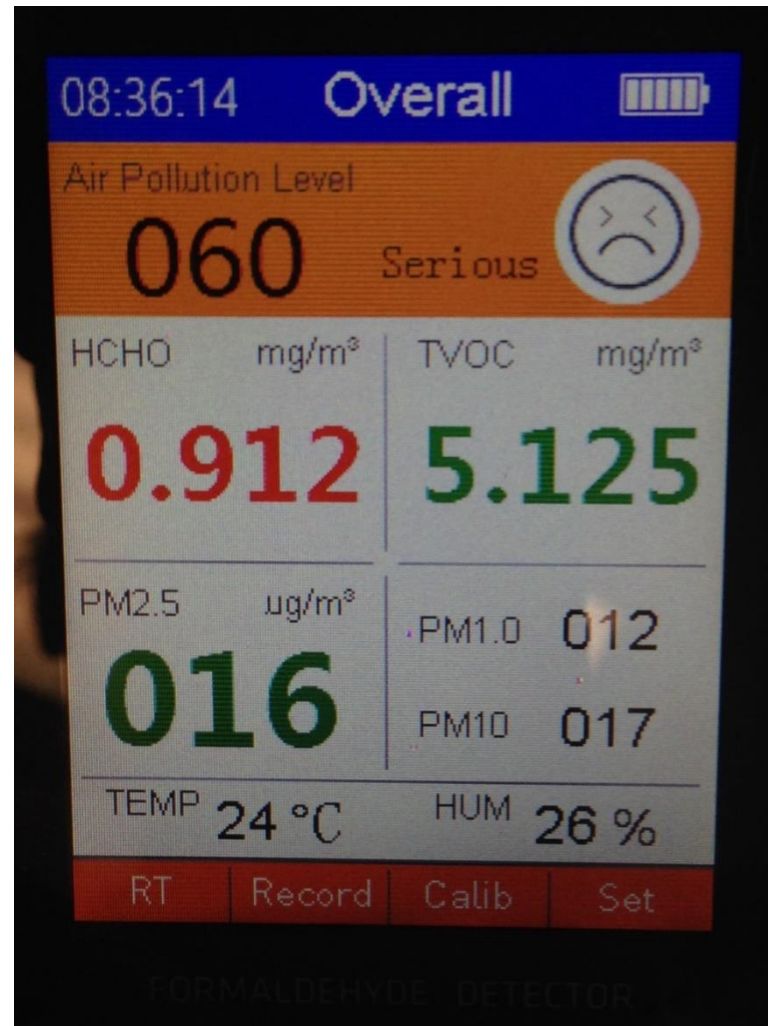
Photocatalytic Coatings Applications



Graffiti Protection & Removal



Before



After FN NANO



FN® NANO Coatings was invented by Jan Prochazka, PhD, and holds two exclusive patents in the USA granted in 2014 and 2015.
The multifunctional FN® Coatings are the result of nanotechnology research.
The nanoparticles do not obstruct the photocatalytic properties of the TiO₂.
Therefore, FN® NANO Coatings are the most effective photocatalytic agents on the market today. They exceed the effectiveness of competing products by up to 100 times.



CANADA Patent 2,707,319

Content of FN2®, and FN3® Nano

Non-Toxic Photocatalytic Coatings

List of Ingredients: Water, titanium dioxide (TiO2), zinc oxide (ZnO), magnesium oxide (MgO), calcium oxide (CaO), calcium carbonate (CaCO3), magnesium carbonate (MgCO3), sodium carbonate (NaCO3), potassium carbonate (KCO3), calcium hydroxide (Ca(OH)), magnesium hydroxide (Mg(OH)).

The calcium, magnesium, sodium, potassium, zinc, and titanium dioxide are suspended in water. When the water suspension is spread over a surface, the mineral compounds, except the titanium dioxide, form a porous inorganic substrate which allows the nanocrystals of titanium dioxide to be exposed on the surface and thus act as powerful photocatalysts.

None of the ingredients of the FN® Nano Photocatalytic coatings are toxic or cause any harm to multi-cellular organisms. Titanium dioxide, has been approved by the Canadian Food inspection Agency as safe food color additive.

The minerals calcium, magnesium, sodium, potassium and zinc are indispensable elements present in the human body. The natural compounds of these elements, such as zinc oxide, calcium carbonate (the substance of eggshells), magnesium hydroxide, etc. are either dietary supplements, and/or medications.





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Canadian Food Inspection Agency



Canada

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Reference Listing of Accepted Construction Materials, Packaging Materials and Non-Food Chemical Products

Last Update: 2017/05/09

[New Search](#)

Company Houston Holdings, Ltd.
Port Alberni, British Columbia, Canada, V9Y 2B4

Category (Sub-Category)	Product Name	Acceptance Date
Coatings for Construction (Coating for walls and ceilings)	FN3® Coating	2012/10/11
Coatings for Construction (Coating for walls and ceilings)	FN2® Coating	2012/10/11
Coatings for Construction (Coating for walls and ceilings)	FN1® Coating	2012/10/11
Coatings for Construction (Coating for floors)	FN3® Coating	2012/10/11
Coatings for Construction (Coating for floors)	FN2® Coating	2012/10/11
Coatings for Construction (Coating for floors)	FN1® Coating	2012/10/11

Number of items found: 6

Date modified: 2015-05-26



Conclusion

Now course participants should be able to:

- **Discuss** the LEED v4 Indoor Environmental Quality (EQ) category and common indoor air quality issues that affect the health of building occupants.
- **Describe** how photocatalytic coatings can help protect the health and comfort of building occupants.
- **Review** how Titanium dioxide (TiO₂) helps eliminate VOCs, allergies, odors, mold, bacteria, and viruses in buildings.
- **Explain** how TiO₂ photocatalytic coatings can clean interior and exterior building surfaces and help combat air pollution.



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CORP. OFFICE & SHOW ROOM
SPRINGFIELD CRESCENT

WATERLOO, ON, N2T 2N1

INFO@FNNANO.CA

ORDERS / TRAINING

226 755 3621

www.FNNANO.ca



**The American
Institute
of Architects**

LIGHT HOUSE 3 MONTHS AFTER HIGH
PRESSURE WATER CLEANING

LIGHT HOUSE RIGHT AFTER
HIGH PRESSURE WATER
CLEANING

THE LIGHT HOUSE AFTER APPLICATION OF FN
NANO COATING, IT WILL STAY NEW FOR 10
YEARS GUARANTEED



Photocatalysis Coatings Process

