

WHITE PAPER: NPURE® SYSTEM EFFICACY AND SAFETY

INTRODUCTION

The NPURE® is powered by the world's most effective and safe disinfection formula, known as PURStrike® (by PURIFYD®SYSTEMS). This formula was originally developed by Sandia National Laboratories (<https://www.sandia.gov/>) over 20 years ago for military and national security applications, with a purpose of providing quick decontamination response against a variety of chemical and biological warfare agents. Since then, primary use of the formula has expanded to commercial, industrial and consumer applications. Sandia's and independent lab testing results show that the formulation works quickly to neutralize both chemical and biological contaminants within minutes, without generating toxic bi-products or surface corrosion. The formula is in active use by US federal institutions such as DEA (Meth lab decontamination), FBI (Decontamination of 2013 Boston Marathon bombing site and 2001 Anthrax attacks on Congressional and commercial office buildings in Washington, D.C., and New York City) and the CDC (2014 Decontamination of Ebola outbreak in Dallas). The U.S military deploys the formula into operational theatres where there is concern for weapons of mass destruction. Fortunately, most of the formula's use in the military is for decontamination of moldy barracks and base housing.

EFFICACY AGAINST CHEMICAL AGENTS & TOXINS

Sandia National Laboratories test results demonstrated high performance against chemical agents, with complete elimination in the order of minutes (Table 1). In addition, nuclear magnetic resonance (NMR) studies showed that destruction of the chemical agents occurred without formation of potentially toxic by-products.

Chemical	Type of Agent	Contact Time (min) for Complete Elimination	By-Product
Soman (GD) Sarin (GB) Tabun (GA) Cyclosarin (GF)	Nerve agent	1-10	Hydrolysis
VX	Nerve agent	1-15	Breakage of P-S Bond
Sulfur Mustard (HD)	Blister agent	30	Oxidation

Table 1: Decontamination of chemical agents (challenge ratio 1:200).

The formula was also shown to be effective against a broad range of chemical toxins (Table 2). The formula successfully neutralized most toxins within 15 minutes, as can be shown below

Toxin	% Decontaminated		
	1 minute	15 minutes	60 minutes
Malathion (liquid)	89	95	Below detection
Hydrogen Cyanide (gas)	>99	>99	>99
Sodium Cyanide (solid)	93	98	>99
Butyl Isocyanate (liquid)	99	Below detection	Below detection
Carbon Disulfide (liquid)	>99	>99	Below detection
Phosgene (gas)	98	>99	>99
Chlorine (gas)	>99	>99	>99
Anhydrous Ammonia (gas)	>99	>99	>99

Table 2: Neutralization of toxic industrial chemicals

EFFICACY AGAINST BIOLOGICAL PATHOGENS, CONTAMINANTS & SPORES

In combating biological pathogens, the formula demonstrates extremely high effectiveness with a 7-log elimination rate (or 99.99999% effectiveness) against bacteria, viruses and spores. The results were confirmed by an external testing done by the U.S Department of Defence as well as subsequent independent lab testing. Elimination of vegetative bacteria and viruses occurred within the first minute, while spores, in general, required 15 minutes exposure to complete elimination (Table 3 example).

Pathogen	Stimulant For	Contact time (min) to complete 7-log elimination
Bacillus atrophaeus	Anthrax spores	15
Yersinia pestis	Plague bacterium spores	15
Erwinia herbicola	vegetative bacterial cells	1
MS-2 & T-4 bacteriophages	Viruses	1
Bovine Corona Virus	SARS-CoV viruses	1

Table 3: 7-log elimination of biological pathogens and spores

Additional tests performed by military facilities and approved independent labs confirmed efficacious neutralization of live chemical agents at various challenge ratios and on select applicable surfaces. Additionally, the formulation has been shown to be efficacious on a wide variety of material surfaces including those with **organic loads and biofilms**.

The list of biological agents, pathogens, and toxins that are eliminated by the formula is quite large. The efficacy of the formula is such that once it has been shown to be effective against a particular pathogen (e.g., SARS), then it is understood to be effective against that complete class of pathogens (Coronaviruses). A more substantive list is shown below (Table 4).

<p>Biological Agent</p>	<p>Bacillus anthracis spores (Anthrax) Yersinia pestis (Plague) Variola major (Smallpox) Fancisella tularensis (Tularemia)</p>
<p>Biological Pathogens</p>	<p>Vibrio cholerae (Cholera) Aptaes Epizooticae (Foot & Mouth Disease) Klebsiella pneumoniae Listeria monocytogenes Clostridium difficile (vegetative) SARS-CoV SARS-CoV-2 Influenza A Influenza B Norovirus Escherichia Coli (E.coli) Salmonella enterica (Salmonella) Staphylococcus aureus (Staphylococcus) MRSA Various Mold Species Saccharomycetales Fungi Trichophyton mentagrophytes Aspergillus niger Penicillium variable Stachybotrys chartarum Xanthomonas axonopodis (Citrus Canker) Pseudomonas aeruginosa Proteus mirabilis Vancomycin Resistant Enterococcus faecalis Enterobacter aerogenes</p>
<p>Biological Toxins</p>	<p>Ricin Botulinum</p>

Table 4: Partial list of biological pathogens and contaminants that are shown to be 7-log eliminated by the formula.

MOLD REMEDIATION & PREVENTION

Mold is arguably one of the most persistent biological contaminants with tenacious spores that can easily grow in wet or high-humidity conditions. Airborne mold spores can penetrate the lungs and cause serious adverse reactions by triggering allergies and asthma attacks. Longer term exposure to toxic molds has been scientifically proven to affect the central nervous system and is a precursor to a number of cancers. The PURStrike® formula is proven to be effective in both remediation and prevention of mold growth, as it works to kill both the mold and its spores. The formulation was superior to undiluted bleach in both remediation and prevention of mold, as demonstrated in the pictures below.

Mold (*Aspergillus versicolor*) remediation and prevention results:



Picture 1: 60 days after mold treatment. Left: Control | Middle: Bleach | Right: PURStrike®

****Mold appears as white stains on the sampled oriented strand board**

After 60 days of treatment, PURStrike® prevents mold re-growth, while the bleach treatment shows inferior prevention.

More mold Remediation results are shown in the picture below.



Picture 2: Mold remediation with PURStrike decontamination formula.

Left: before treatment. Right: 3 hours after treatment.

CONCLUSION

The PURStrike® decontamination formula that is used with NPure® Dry Fogging technology was tested rigorously and found to be 99.99999% effective against a broad spectrum of biological pathogens and contaminants. In addition, the formula is proven to neutralize a wide variety of chemical agents and toxins, typically within minutes. The formula is also efficacious against bacterium spores, meaning it will not only kill the mold or pathogen, but will also prevent its re-growth for a very long period of time. Since there are no toxic bi-products or surface corrosion, the formula is safe for use in agricultural, livestock, commercial, industrial, food processing and handling and consumer applications and is registered with Health Canada under the same regulations that control prescription drugs. When applied as an NPure® dry fog, the formula particles are guaranteed to reach all corners of the room, disinfecting both surfaces and airborne pathogens within minutes.

Data source: Sandia National Laboratories