

Sandia Decon Formulation for Mitigation and Decontamination of Chemical and Biological Warfare Agents, Chemical Toxins, and Biological Pathogens

Test Results

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Technology Description

In response to a national initiative to combat the domestic chemical and biological warfare (CBW) threat, Sandia National Laboratories (SNL) has developed Sandia Decon Formulation for mitigation and decontamination of chemical and biological (CB) agents. Experimental results indicate that the formulation works quickly and does not generate toxic by-products. Originally developed as DF100, the SNL formulation has been enhanced to achieve quicker decontamination efficacy over the broad range of both chemical and biological warfare agents, many chemical toxins, and biological pathogens. Results of the enhanced formulation, DF200, are highlighted in this publication.

Performance Against Chemical Warfare Agents and Chemical Toxins

In SNL tests of Sandia Decon Formulation performance against chemical warfare (CW) agent simulants, half-lives for the decontamination of the simulants were on the order of minutes. Also, nuclear magnetic resonance (NMR) studies demonstrated that destruction of the CW simulants occurred without formation of potentially toxic by-products. The simulant test results were confirmed by a facility licensed to perform live CW agent testing. In liquid solution tests, DF200 achieved complete neutralization of CW agents within minutes (Figure 1).

Decontaminant	HD		GD		VX	
	15 min	1 hr	15 min	1 hr	15 min	1 hr
% Decontamination	>98	100	>99	100	>99	100

Figure 1. Decontamination of HD, GD, and VX by DF200 (challenge ratio of 1:200).

Because of their high toxicity, common transport across U.S. highways and high availability, many toxic industrial chemicals are considered by the FBI to be a higher threat for terrorist use than conventional weapons of mass destruction. Sandia has developed a small suite of modified DF200 formulations that are highly effective at neutralizing most classes of toxic industrial chemicals. Malathion, sodium cyanide, butyl isocyanate, and carbon disulfide were analyzed in solution; headspace analyses were conducted for hydrogen cyanide, phosgene, chlorine, and ammonia. Results obtained both at SNL and at Southwest Research Institute (San Antonio, TX) are shown in Figure 2.

Toxic Industrial Chemical	% 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

Figure 2. Neutralization of toxic industrial chemicals.

Performance Against Biological Warfare Agents and Biological Pathogens

Four biological agent simulants were used in SNL tests of DF200 decontamination performance: *Bacillus atrophaeus* (a simulant for anthrax spores), *Erwinia herbicola* (a simulant for vegetative bacterial cells), and

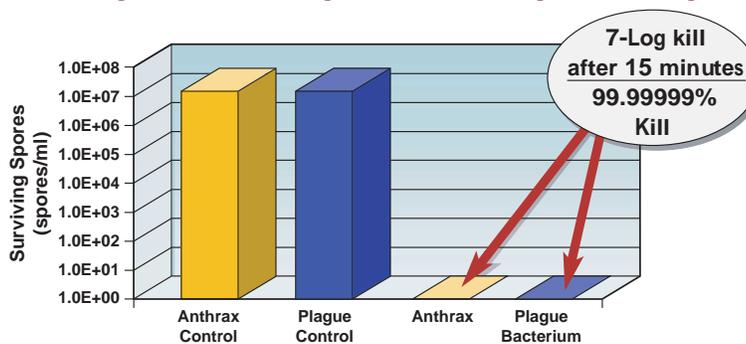


Figure 3. Anthrax and plague bacterium spore kill.

MS-2 and T-4 *bacteriophages* (both simulants for viruses). Highly effective simulant test results of a 7-log kill within 15 minutes were confirmed by a facility licensed to perform live agent testing of two different strains of a live anthrax agent and the plague bacterium. In a solution test (i.e., the spores were added to the formulation), a 7-log kill of both live anthrax and plague bacterium was achieved during a 15-minute exposure period to DF200 (Figure 3).

A SNL-based formulation has also been shown to completely inactivate Bovine Corona Virus (BCV), the internationally recognized surrogate for Severe Acute Respiratory Syndrome (SARS). After 1-minute exposure to a reduced 10% concentration of the standard DF200 formulation, BCV was successfully inactivated. Viral inactivation was determined indirectly by assessing hemagglutinin (a second co-receptor on the surface of the BCV) activity. Inactivation of the hemagglutinin indicates loss of BCV infectivity. Testing was completed with and without the presence of 10% by weight solutions of various organic loads (Figure 4).

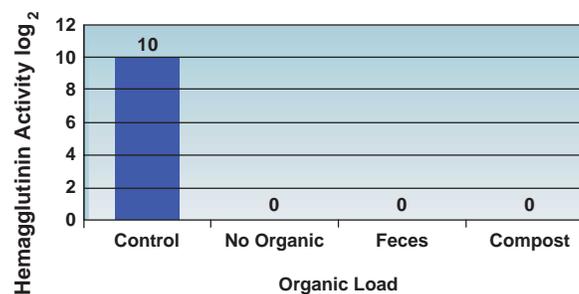


Figure 4. SARS surrogate after 1 minute exposure to DF200D.

Additional tests performed by approved military facilities confirm efficacious neutralization of live warfare 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.

Sandia is a multiprogram laboratory operated by Sandia Corporation, a Lockheed Martin Company, for the United States Department of Energy's National Nuclear Security Administration under contract DE-AC04-94AL85000.

Patent Issued

U.S. patent number 6,566,574 B1 was granted on May 20, 2003. Additional U.S. and international patent applications are pending. The U.S. Government retains the technology for U.S. Government use. The U.S. Government has granted SNL the right to license and commercialize the technology.

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