

FirstLink



The Department of Defense National Center of Excellence for First Responder Technology Transfer

Hazardous Materials Decontamination Platform

Patent: US 6,895,871 B1

Market Overview

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And

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Executive Summary

DQE, Inc. (DQE) of Fishers, Indiana has licensed a Hazardous Material Decontamination Platform (Decon Platform) from the Naval Surface Warfare Center—Crane Division (NSWC—Crane) in Crane, Indiana. The Decon Platform claimed under United States Patent 6,895,871 B1 is a portable, re-usable, elevated platform providing a large, non-slip, grated surface on which an individual wearing a fully-encapsulated, hazardous materials suit may stand, and turn to ensure thorough on-site decontamination.

This analysis provides a general overview of the Decon Platform and prospective market opportunities. The primary markets examined within which the Decon Platform may find relevance include, but are not limited to; the *military* and *commercial decontamination markets*. Each potential market is defined, quantified, and market drivers and influences are explored. A summary of the information contained within the full assessment is provided below.

Technical Synopsis

The Decon Platform may be employed in situations for which human decontamination operations may be warranted in response to incidents where hazardous materials may come into contact with members of the populace. The prospective advantages of the Decon Platform include:

- Increased stability and safety
- Enhanced durability
- Expedited decontamination process
- Enhanced portability
- Easy to store and deploy

While DQE, Inc. may have established client relationships in the civilian first responder market, entrance into the military and commercial markets may be met with several hurdles. Identifying and developing strategic relationships with firms that currently compete within these two markets may serve to enhance the Decon Platform penetration into these two target markets. As such, one important step in moving toward commercialization may be identifying potential partners with existing sales channels into these two markets, and for which the Decon Platform may serve to enhance their existing product lines that serve such markets.

Markets and Competitive Landscape

The Decon Platform may find specific advantages in situations where a portable, re-usable, elevated platform providing a large, non-slip, grated surface may enhance the decontamination efforts of the military and commercial segments. Existing operations employ several platform-like solutions to fill existing need for elevated platforms. The Decon Platform may offer an

enhancement to existing technologies by providing a solution that may be fully integrated into the decontamination process.

Competition for the Decon Platform includes products specifically designed for being employed in decontamination activities to products that were developed to serve different purposes as well. There are well-developed solutions within the marketplace. The Decon Platform may then offer enhancements to both of these types of products, enhancing the overall efficiency and effectiveness of the decontamination process.

Within the military market, there are several firms that currently serve various end user groups, and may be viewed as both competition, and potentially strategic partnership targets. Firms with existing sales channels into the military market may represent strategic targets, as the Decon Platform may enhance their overall value proposition to the military market, and leveraging these existing sales channels may enhance the Decon Platform's ability to gain adoption in this potentially valuable segment.

That said, ultimate adoption by the military and other end user segments may focus on the degree to which the Decon Platform enhances their existing decontamination efforts, and if the added benefits that it presents outweigh the cost of adopting or switching from existing products.

Conclusion

Overall, market indicators appear favorable in both First Responder and military decontamination applications. However, market penetration for the Decon Platform may ultimately hinge on the enhancements that it provides to those engaged in decontamination efforts, and the degree to which those enhancements create greater utility to the prospective end users. In other words, the prospective advantages provided by the Decon Platform appear to be relevant in these applications, but the platform will need to be perceived as cost effective and adding additional utility over the currently deployed solutions as well.

1 Introduction

DQE, Inc. (DQE) of Fishers, Indiana has licensed a Hazardous Material Decontamination Platform (Decon Platform) from the Naval Surface Warfare Center—Crane Division (NSWC—Crane) in Crane, Indiana. The Decon Platform claimed under United States Patent 6,895,871 B1 is a portable, re-usable, elevated platform providing a large, non-slip, grated surface on which an individual wearing a fully-encapsulated, hazardous materials suit may stand, and turn to ensure thorough on-site decontamination.

In light of the Decon Platform's enhancements over existing decontamination platforms, it may provide the following advantages

- Increased stability and safety
- Enhanced durability
- Expedited decontamination process
- Enhanced portability
- Easy to store and deploy

In addition to examining the Decon Platform's key components and operation, and how the advantages may be achieved, this assessment provides an overview of the potential opportunity within the military and commercial markets. This report is broken down as follows:

- Technical Synopsis and Applications
- Markets
- Competitive Synopsis
- Conclusion

Ultimately, the Decon Platform is designed to enhance decontamination efforts in a number of potential markets. Based on the data examined, indicators appear positive but are matched by several go-to-market needs including target market perceptions of the value add that the Decon Platform may provide in decontamination operations. It is important to note that this analysis is not undertaken in an effort to dictate commercialization strategies or to recommend a specific market application. Rather, a general overview of the Decon Platform's functionality and the markets to which it may enter are provided for further strategic analysis.

2 Technical Synopsis

DQE, Inc. (DQE) of Fishers, Indiana has licensed a Hazardous Material Decontamination Platform (Decon Platform) from the Naval Surface Warfare Center—Crane Division (NSWC—Crane) in Crane, Indiana. The Decon Platform claimed under United States Patent 6,895,871 B1 is a portable, re-usable, elevated platform providing a large, non-slip, grated surface on which an individual wearing a fully-encapsulated, hazardous materials suit may stand, and turn to ensure thorough on-site decontamination. The limitations of current solutions prompted the invention of this platform for decontamination¹. Further, upon licensing, DQE expanded upon the features of the technology described in the patent². This technical synopsis takes into account both the features from the patent and those that DQE has added.

2.1 Background on Hazardous Materials (Hazmat) and Decontamination

In order to understand the field of the Decon Platform, hazardous materials (hazmat) and the decontamination process should be understood. Hazardous material denotes any item or agent (*e.g.*, chemical, biological, radiological, nuclear, environmental, or physical) that has the potential to cause harm to humans, animals, or the environment—either alone or in combination with other factors. Hazardous material contamination can be generalized under three (3) categories:³

- ***Accidental Releases***—the most common type of incident that includes all types of spills or leaks of toxic agents that are unintentional in nature—accidental or human error.
- ***Domestic Terrorism***—when deadly chemical/biological (CBW) agents are intentionally released into the general population with the objective of harming that population.
- ***Intentional Releases***—when companies and/or individuals knowingly or illegally emit or dump toxic waste into landfills, waterways, the atmosphere, or the environment, in general.

When hazardous materials have contaminated a site or surface, clean up is not only required, but mandatory⁴. Since the early 1900's hazardous materials have had both a direct and indirect

¹ Smith, William & Roger Enochs. United States Patent 6,895,871 B1. 24 May 2005.

² Baumgartner, Tony. DQE, Inc. Telephone correspondence 19 Aug 2011.

³ Firefighter hazmat team, <http://www.seattle.gov/fire/ffighting/operations/hazmat.htm>

⁴ "Hazards." *Labor Occupational Health Program*. UC Berkley, 2011. Web. .
<<http://www.lohp.org/graphics/pdf/hw24en02.pdf>>.

impact on our lives—potentially compromising the safety of individuals and/or the integrity of the site(s) and/or surface(s) they have come into contact.

Acts of contamination are typically managed geographically, and if the event is dispersed over a long period of time, can potentially require coordination of Federal, State, local, private sector, and non-governmental organizations⁵. Quick and easy decontamination is critical for facilities and equipment to avert additional casualties. After a contamination event has been identified, the contaminated area is categorized into “zones.” These zones are hot, warm, and cold. Below is what could be considered a “typical” zoned disaster area, although nothing is typical about a contamination event.⁶

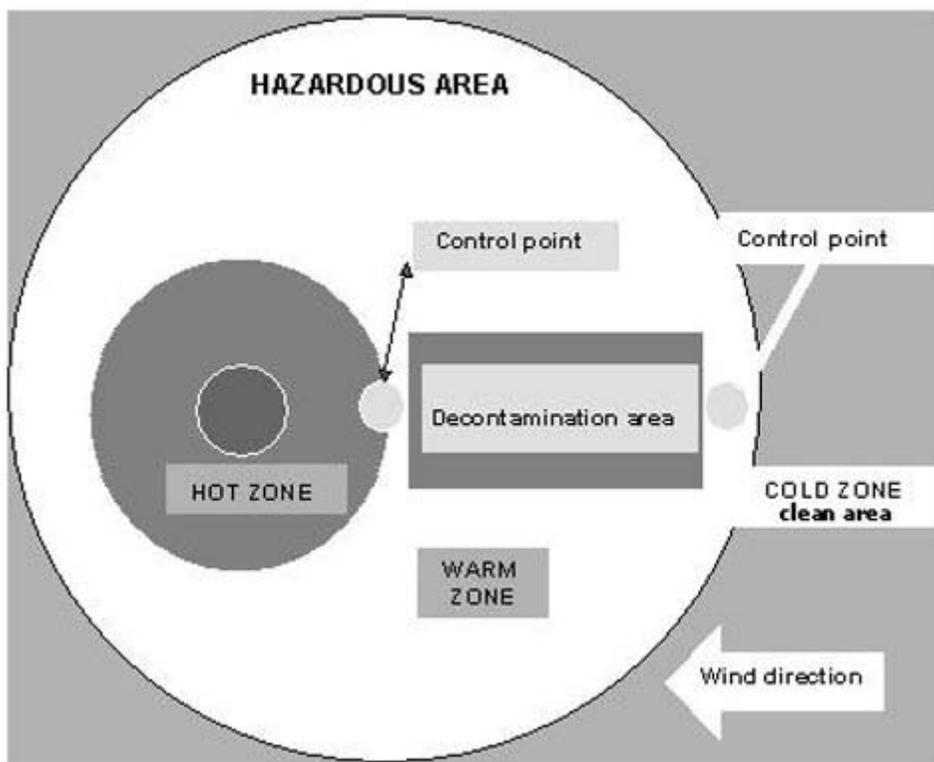


Figure 1: **Incident Management Zones**

All those involved in clean-up must take precaution and be certain to wear the appropriate type of clothing to prevent exposure and contamination to their own persons—at the very least, a

⁵ Homeland Security, “National Incident Management System,” March 1, 2004.

⁶ Kenar; L., Karayilanoglu; T, “Prehospital Management and Medical Intervention After a Chemical Attack,” *Emerg Med J* 2004;21:84-88.

respirator, personal protection equipment, and a protective over garment. A fully-encapsulated suit is typical. Before returning to a “clean zone” those entering the hazardous area must be decontaminated as well, usually while wearing the fully-encapsulated suit. This process typically involves washing the suits with a decontamination solution while the hazmat personnel wear them. A picture below illustrates this process.



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Figure 2: Decontamination Pools with Crate

2.2 Historical Solutions

The picture above also illustrates the current solution used for decontamination of hazmat personnel. As can be seen, the contaminated runoff must be collected in a vessel of some sort and therefore the hazmat personnel must be elevated. United States Patent 6,895,871 B1 describes that any convenient implement has been used as a platform, including plastic or metal “milk”-style crates and plastic pallets, as well as formal product lines established by companies

⁷ Picture provided by DQE, Inc. from shutterstock.com

in this segment. While convenient, these solutions bring with them safety concerns. These safety concerns include:

- Insufficient structural strength to support the weight of both the responder and the suit
- Insufficient lateral stability while stepping on and off the platform
- Insufficient physical size (length and width)

These concerns are further heightened when considering responders' vision and dexterity are compromised while wearing a fully-encapsulated hazmat suit. Due to these limitations and potential safety issues, the Decon Platform was invented.

2.3 Hazardous Material Decontamination Platform (Decon Platform)

With these shortcomings noted, the Naval Surface Warfare Center—Crane Division (NSWC—Crane) developed the Decon Platform with the intent of overcoming the limitations of prior art. DQE, Inc. (DQE) recognized the prospective advantages such a system could offer, licensed the Decon Platform, and added additional features.

The Decon Platform claimed in United States Patent 6,895,871 B1 is a portable, re-usable, elevated platform providing a large, non-slip, grated surface on which an individual wearing a fully-encapsulated, hazardous materials suit may stand, and turn to ensure thorough on-site decontamination. The platform comprises a top grate and two folding/pivoting support leg assemblies with locking pins, which lock in position for storage, are sealed to prevent cross-contamination, and are turned slightly upward at the ends to prevent damaging a containment vessel. Further, the platform is to be made of lightweight materials. The platform claimed by the patent is illustrated below.

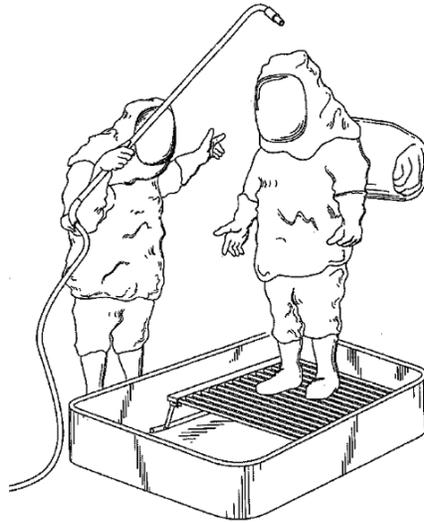


Figure 3: Drawing of the Decon Platform claimed in US Patent 6,895,871 B1

As previously mentioned however, the claims of the patent only make up part of the final solution that DQE intends to commercialize. Their further developments are also part of the final product. Although prototypes of the current configuration exist, new designs and added features place the Decon Platform at a technology readiness level (TRL) 2-3. DQE has decided that the platform will be made of aluminum, and their additions to the Decon Platform include:

1. A stability rail
2. A small seat or bench that will be collapsible and/or disconnect and lock into the platform for storage
3. Wheels—making it deployable by one of two people
4. Additional possible features such as shower attachments

In discussions with DQE, the Decon Platform could be a stand-alone product offered with a contamination collection vessel or part of a larger decontamination solution (ie: decontamination shower, etc.) Considering these additions, the Decon Platform could be the first multi-functional metal platform on the market. The device is intended to still be portable and collapsible, and will be compatible with existing vehicle designs. Existing vehicles would be outfitted with cords to secure the platform in its collapsed configuration. DQE's envisioned design is pictured below.

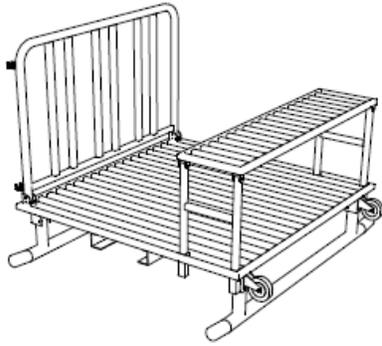


Figure 4: Drawing of the updated Decon Platform deployed

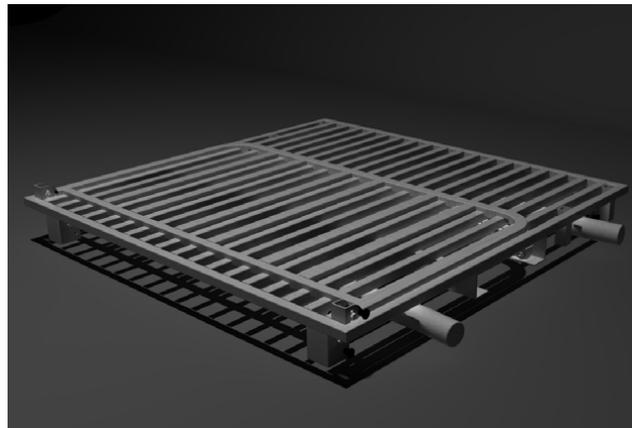


Figure 5: Illustration of the updated Decon Platform collapsed



Figure 6: Illustration of the updated Decon Platform deployed

2.4 Prospective Advantages

Based upon the claims in US Patent 6,895,871 B1 and the further development done by DQE, the Decon Platform may then have the following prospective advantages:

Table 1: Decon Platform Prospective Advantages	
Prospective Advantage	Description
Increased stability and safety	The larger area of the grate, the stability rail, and the seat all may increase stability and safety.
Durable	The platform is made of aluminum which is resistant to weather and hazardous materials.
Expedited decontamination process	The larger grate area may allow for one responder to begin entering the platform while another is exiting, which cannot currently be done. This may expedite the decontamination process.
Portable	Wheels have been integrated into the design of the platform, and it is made of lightweight aluminum, which may allow for one or two person deployment.
Easy to store and deploy	The platform, including the bench and the rail, collapses into a flat configuration with all pieces locking together, making it easy to store. The system is also easy to set up.

3 Applications

As the prospective advantages of the Decon Platform are that which are described in the technology synopsis component of this assessment, the main applications for which the Decon Platform may include, but are not limited to:

- Use in CBRNe decontamination situations where a portable platform may be employed to enhance decontamination efforts.

4 Markets

Markets

According to a recent Homeland Security Research report entitled *Nuclear and Bio-Chem Incidents: Decontamination Technologies and Global Market – 2011 to 2016*, the global market for decontamination technologies is expected to grow from \$2.7 billion in 2010 to roughly \$6.25 billion in 2014.⁸ Within the overall decontamination technologies market, two broad categories encompass the types of services and products that account for the revenues generated:

- Services, consumables and upgrades
- System Sales

Of the two categories considered, *system sales* currently account for the largest amount of revenue, with roughly \$1.8 billion in revenues in 2010. System sales in 2014 are expected to be near \$4 billion globally.⁹

The North American market accounts for a comparatively large percentage of global decontamination industry revenues. Overall revenues in 2008 were \$705 million, with *people decontamination and systems* accounting for \$276 million. This segment is expected to grow to \$538 million in 2014, a compound annual growth rate of (CAGR) of 11.1%.¹⁰ Overall, the North American market is expected to grow at a CAGR of 12.3% from 2008 to 2014.¹¹ The chart below articulates growth in the three major decontamination segments:¹²

- Detection Systems
- Equipment and Building Decontamination
- **People Decontamination and Systems**

⁸ "Reportlinker Adds Nuclear and Bio-Chem Incidents: Decontamination Technologies and Global Market 2011-2016." *PR Newswire*. United Business Media, 06 Jun 2011. Web.

⁹ Ibid

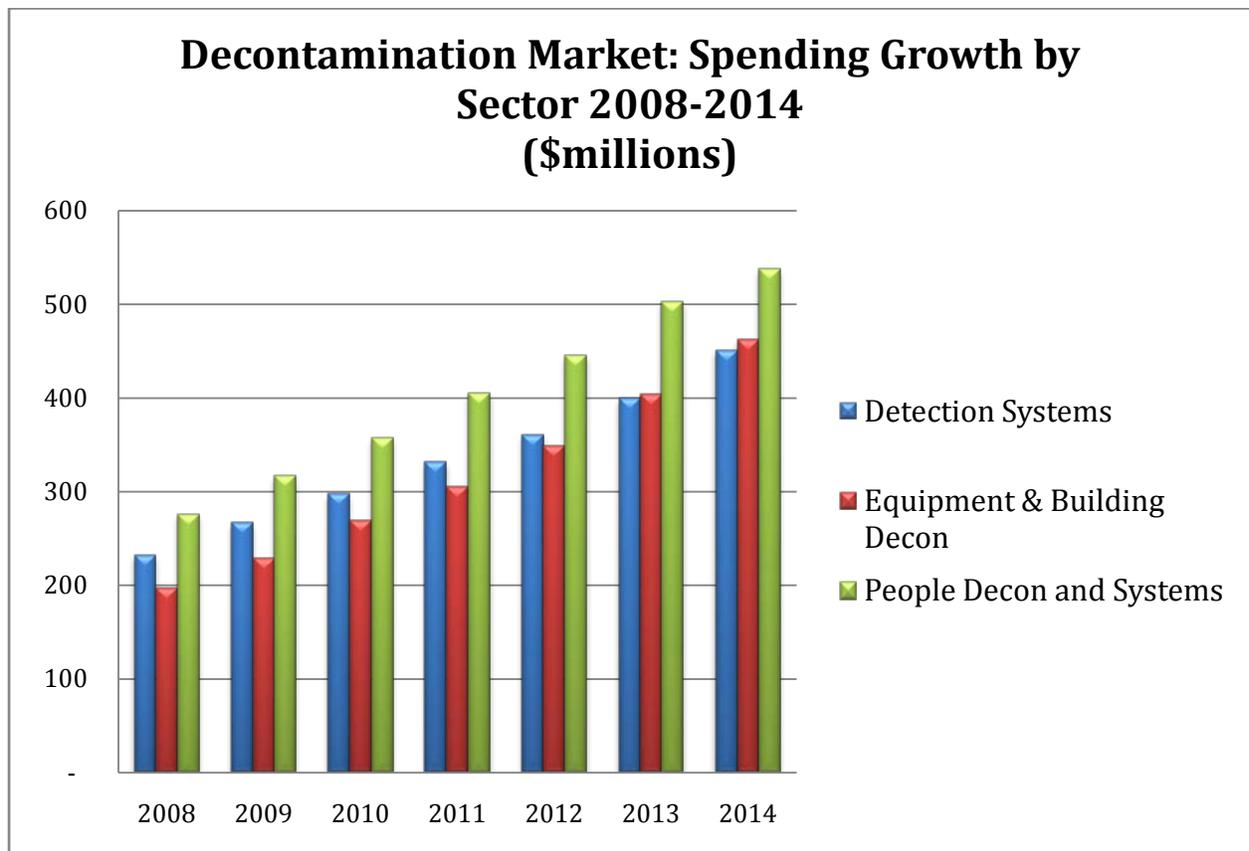
¹⁰ "The Decontamination and Hazardous Materials Market." *NDIA*. National Defense Industrial Association, 2011. Web.

¹¹ Ibid

¹² Ibid

Table 2: Decontamination Market: Spending Growth by Sector (2008-2014) \$millions								
Segment	2008	2009	2010	2011	2012	2013	2014	2009-2014
Detection Systems	232	267	298	332	361	400	451	2,109
Equipment & Building Decon	197	229	269	305	349	404	463	2,019
People Decon and Systems	276	317	357	405	446	503	538	2,566
Total Sales	705	813	924	1,042	1,156	1,307	1,452	6,694

Figure 7: Decontamination Market: Spending Growth by Sector 2008-2014



It may be noted that while all segments within the decontamination market are expected to exhibit positive growth through 2014, the equipment and building decontamination segment is expected to grow at the greatest rate with 15.1% CAGR. That said, people decontamination and systems is expected to account for the largest amount of revenue through the same period. This assessment understands that it is within this category of people decontamination that the Decon Platform may hold the greatest relevance and as such may represent the category for which

revenue growth projection may prove most appropriate to consider in building an understanding of the potential size of the segment within which the technology may compete.

Moving forward, this assessment will work to evaluate the market potential for two major end user segments:

- Military Decontamination
- Commercial Decontamination

4.1 Military Decontamination Market

4.1.1 Military Quantification

Acknowledging potential market relevance established by the Decon Platform's product predecessors and established military end-users, the military market is first defined to include the five branches of the United States military: Air Force, Army, Coast Guard, Marine Corps, and Navy. The tables below relay the United States Bureau of Labor Statistics 2009 estimates of current enlistment.¹³ It is these enlisted and officer personnel who may constitute the military market and which may serve as potential end-users of the Decon Platform.

¹³ United States Bureau of Labor Statistics. "Occupational Outlook Handbook, 2010-11 Edition ." *Job Opportunities in the Armed Forces*. 17 Dec 2009. United States Department of Labor, Web. Mar 2010. <<http://www.bls.gov/oco/ocos249.htm>>.

Table 3: Military Enlisted Personnel by Broad Occupational Category & Branch of Military Service, January 2009						
Occupational Group - Enlisted	Army	Air Force	Coast Guard	Marine Corps	Navy	Total, all services
Administrative occupations	6,727	17,537	1,621	9,219	22,147	57,251
Combat specialty occupations	132,079	480	904	52,445	7,595	193,503
Construction occupations	20,872	4,689	—	6,759	5,521	37,841
Electronic and electrical repair occupations	37,466	34,751	4,663	16,199	47,985	141,064
Engineering, science, and technical occupations	42,770	41,328	1,212	26,940	38,778	151,028
Healthcare occupations	30,945	16,420	772	—	23,960	72,097
Human resource development occupations	20,251	11,321	1	7,134	5,300	44,007
Machine operator and precision work occupations	6,372	6,181	1,816	2,575	8,596	25,540
Media and public affairs occupations	8,233	6,910	152	2,518	3,659	21,472
Protective service occupations	29,076	34,099	2,816	7,156	12,555	85,702
Support services occupations	13,554	6,071	1,263	2,765	9,188	32,841
Transportation and material handling occupations	69,454	31,396	11,748	25,909	45,176	183,683
Vehicle machinery mechanic occupations	54,771	43,409	6,119	22,068	45,209	171,576
Non-occupation coded personnel	1,081	6,681	326	12	755	8,855
Total, by service	473,651	261,273	33,413	181,699	276,424	1,226,460

Table 4: Military Officer Personnel by Broad Occupational Category & Branch of Military Service, January 2009

Occupational Group - Officer	Army	Air Force	Coast Guard	Marine Corps	Navy	Total, all services
Combat specialty occupations	20,201	2,611	77	5,315	1,125	29,329
Engineering, science, and technical occupations	21,676	17,800	210	4,006	7,616	51,308
Executive, administrative, and managerial occupations	13,104	7,327	197	2,725	5,442	28,795
Healthcare occupations	10,626	8,661	1	—	7,468	26,756
Human resource development occupations	2,676	2,293	151	279	520	5,919
Media and public affairs occupations	310	305	15	175	290	1,095
Protective service occupations	2,867	1,131	60	353	284	4,695
Support services occupations	1,741	758	3	38	857	3,397
Transportation occupations	12,519	22,828	580	7,345	27,340	70,612
Non-occupation coded personnel	2,597	866	6,769	88	386	10,706
Total, by service	88,317	64,580	8,063	20,324	51,328	232,612

Within the above tabulations, the total military market (as defined via BLS estimates of officer and enlisted personnel) is that of 1,459,072 members. While some of these occupations may be more likely (*i.e.* combat specialty occupations) to employ the Decon Platform than others (*i.e.* human resources); this assessment will adopt the general quantification of enlisted and officer personnel to initially quantify the military market. That said, and based upon BLS definitions, two of the above BLS classified occupational groups may have an increased likelihood of duties relevant to Decon Platform application: (1) *Combat Specialty Occupations* and (2) *Protective Service Occupations*. BLS definitions for these occupations are as follows:¹⁴

- **Combat Specialty Occupations:** include enlisted specialties, such as infantry, artillery, and Special Forces, whose members operate weapons or execute special missions during combat. People in these occupations normally specialize by type of weapon system or combat operation. They maneuver against enemy forces and positions, and fire artillery, guns, mortars, and missiles to destroy enemy positions. They also may operate tanks and amphibious assault vehicles in combat or on scouting missions. When the military has especially difficult or specialized missions to perform, it calls upon Special Forces teams.. Team members from the Special Forces conduct offensive raids, demolitions, intelligence, search-and-rescue missions, and other operations from aboard aircraft, helicopters, ships, or submarines. These end users may hold increased propensity to employ the Decon Platform as they execute front-line operations, including those which may involve chemical agents.
- **Protective Service Occupations:** include those who enforce military laws and regulations and provide emergency responses to natural and human-made disasters. For example, military police control traffic, prevent crime, and respond to emergencies. Other law enforcement and security specialists investigate crimes committed on military property and guard inmates in military correctional facilities. Firefighters put out, control, and help prevent fires in buildings, on aircraft, and aboard ships.

While the above BLS definitions are broad, this scope may serve to support the increased likelihood of said end-users employing the Decon Platform. Beyond the general quantification of 1,459,072 military end-users (as defined via BLS estimates of officer and enlisted personnel), the market may be further delineated to 193,503 combat specialty enlisted personnel and 85,702 protective services enlisted personnel. It is important to note that *officer* personnel, while grouped in similar categories, are not designated by BLS definitions to include front-line engagement. Thus, while it may be assumed that officer

¹⁴ United States Bureau of Labor Statistics. "Occupational Outlook Handbook, 2010-2011 Edition.: Job Opportunities in the Armed Forces. Dec. 17, 2009. United States Department of Labor, Web. May 2010. < <http://bls.gov/oco/ocos249.htm#employ>>.

personnel will likely be present in the event of chemical incident or chemical detection, they may not prove to be direct end-users of the Decon Platform. Thus, the table below excludes officer personnel of combat specialty and protective service occupational groups—29,329 and 4,695 respectively.

Table 5: BLS Occupational Groups of Enlisted Personnel: Combat Specialty and Protective Service						
	Army	Air Force	Coast Guard	Marine Corps	Navy	Total, all services
Combat specialty	132,079	480	904	52,445	7,595	193,503
Protective service	29,076	34,099	2,816	7,156	12,555	85,702
Total	161,155	34,579	3,720	59,601	20,150	279,205

SOURCE: U.S. Department of Defense, Defense Manpower Data Center, BLS

Similar to the BLS’s occupational groups, Military Occupational Specialties (MOS) specifically designated to chemical, biological, radiological and nuclear (CBRN) detection may offer further insight into potential market size for the Decon Platform. The Air Force, Army, and Marine Corps have a MOS specifically designated to CBRN detection or have a MOS which relays CBRN duties. Military end-users classified by the military occupational specialties tabulated and outlined below may carry an enhanced likelihood of employing the Decon Platform.

Table 6: Military CBRN Designations	
U.S. Military Branch	Occupation Specialty with Potential CBRN Relevance
Air Force	<ul style="list-style-type: none"> • AFSC 3EX1 (Explosive Ordnance Disposal) • AFSC 3E9X1 (Emergency Management) <p><i>AFSC: Air Force Specialty Code</i></p>
Army	<ul style="list-style-type: none"> • MOS 74D (CBRN Specialist) • MOS 74A (CBRN Concentration for Officers)
Marine Corps	<ul style="list-style-type: none"> • MOS 57 (CBRN Defense) • MOS 5711 (Enlisted CBRN Defense Specialist) • MOS 5702 (Officer CBRN Defense Specialist)
Navy	<ul style="list-style-type: none"> • Navy Enlisted Classification 9598 • NOBC 2715 (Disaster Preparedness Officer) • NOBC 2765 (CBRN Defense Officer)

Two Specialty Codes within the United States Air Force make specific mention of CBRN training and capacity—Air Force Specialty Codes (AFSC 3E8X1, Explosive Ordnance Disposal and AFSC 3E9X1, Emergency Management. Included in the duties of AFSC 3E8X1 is the use of monitoring and detecting equipment (*e.g.* the Decon Platform) when an ordnance may contain or be contaminated with toxic, biological or radioactive materials, and the detection, monitoring, evaluation and decontamination of explosive, radioactive, chemical or biological ordnance hazards.¹⁵ Included in the duties of AFSC 3E9X1 are the maintenance and inspection of NBC equipment, and the conduction of relevant detection, warning, and reporting activities.¹⁶

The Army's Chemical, Biological, Radiological, and Nuclear (CBRN) Specialist is designated by MOS 74D and the area of concentration for officers is 74A. The 74D CBRN Specialists plan, employ, and coordinate CBRN defense systems in support of joint and combined arms operations including CBRN reconnaissance systems, biological agent detection systems (BIDS), obscurant systems, CBRN decontamination systems, and other CBRN hazard detection and warning systems.¹⁷ The Army is said to have the largest number of uniformed personnel tasked with the CBRN defense mission, totaling at least 22,000 across the regular army and reserve components.¹⁸

The Marine Corps MOS 57 is that of Chemical, Biological, Radiological and Nuclear Defense (CBRN). The CBRN Defense field includes the detection, identification, warning, reporting, protection, avoidance, and decontamination procedures associated with CBRN hazards and contamination on the battlefield.¹⁹ MOS 5711 designates *enlisted* CBRN Defense Specialists, and MOS 5702 designates officer CBRN Defense Specialists. As opposed to the field-based duties of the MOS 5702, the latter CBRN Defense Officers function as supervisors, coordinators, and technical advisors to the commanding *officer* for operational and technical functions associated with CBRN defense related issues.²⁰

¹⁵ "Air Force Enlisted Job Descriptions 3E8X1- Explosive Ordnance Disposal." *About.com*. The New York Times Company, 2010. Web. 6 May 2010. <<http://usmilitary.about.com/od/airforceenlistedjobs/a/afjob3e8x1.htm>>.

¹⁶ "Air Force Enlisted Job Descriptions 3E9X1- Emergency Management." *About.com*. The New York Times Company, 2010. Web. 6 May 2010. <<http://usmilitary.about.com/od/airforceenlistedjobs/a/afjob3e9x1.htm>>.

¹⁷ "Army Enlisted Job Descriptions and Qualification Factors 74D - Chemical, Biological, Radiological and Nuclear (CBRN) Specialist." *About.com*. The New York Times Company, 2010. Web. May 7 2010. <<http://usmilitary.about.com/od/enlistedjobs/a/74d.htm>>.

¹⁸ Walk, Robert. "Purple Dragons: Should the Chemical Corps Become Joint?." *Army Chemical Review* Winter 2009: 41-43. Print.

¹⁹ "United States Marine Corps Enlisted Job Description and Qualification Factors Field 57, Chemical, Biological, Radiological, and Nuclear Defense." *About.com*. The New York Times Company, 2010. Web. May 07 2010. <<http://usmilitary.about.com/od/enlistedjo2/a/57.htm>>.

²⁰ "Marine Corps Officer Job Descriptions MOS 5702 - - Chemical, Biological, Radiological and Nuclear Defense Officer ." *About.com*. The New York Times Company, 2010. Web. 08 May 2010. <<http://usmilitary.about.com/od/officerj3/a/5702.htm>>.

There is no pure CBRN specialty within the bounds of the Navy. However, enlisted CBRN capabilities are covered under Navy Enlisted Classification 9598 (disaster preparedness operations and training specialist). These specialists focus on preparing for major accidents and CBRN operations. Officer specialties include Navy Officer Billet Classification (NOBC) 2715 (disaster preparedness officer) and NOBC 2765 (nuclear, biological, and chemical defense officer).²¹

While there is not specific quantification for the occupational specialties outlined above, military end-users whose duties are specifically oriented towards CBRN detection and defense may carry increased likelihood of employing the Decon Platform. When these occupational specialties are accepted as a potential market indicator for the Decon Platform, market opportunity appears apt as each branch of the United States military may have capacity relevant to the Decon Platform application.

The locations of military service and agency sites which may constitute the prospective military context to which the Decon Platform may be deployed are graphed below.²² A "site" is defined by the Department of Defense as a specific geographic location where the DoD owns or manages land, buildings, structures or linear structures. Sites are assigned to military installations. A site may exist in one of three forms: land only (where there are no facilities present); facility or facilities only (where the underlying land is neither owner nor controlled by the government); and land and facilities. An installation is commonly referred to as a base, camp, post, station, yard, center, homeport facility for any ship, or any other activity under the jurisdiction, custody or control of the DoD. Further definitions can be sought by consulting the relevant source.²³

In general, the DoD manages a property portfolio consisting of more than 539,000 facilities (buildings and structures) located on more than 5,570 sites, on approximately 29 million acres. According to the Office of the Deputy Under the Secretary of Defense (Installations and Environment), the DoD footprint encompasses the 50 states, 7 territories, and 38 foreign countries. The majority of foreign sites are located in Germany (235), Japan (123), and South Korea (87).²⁴

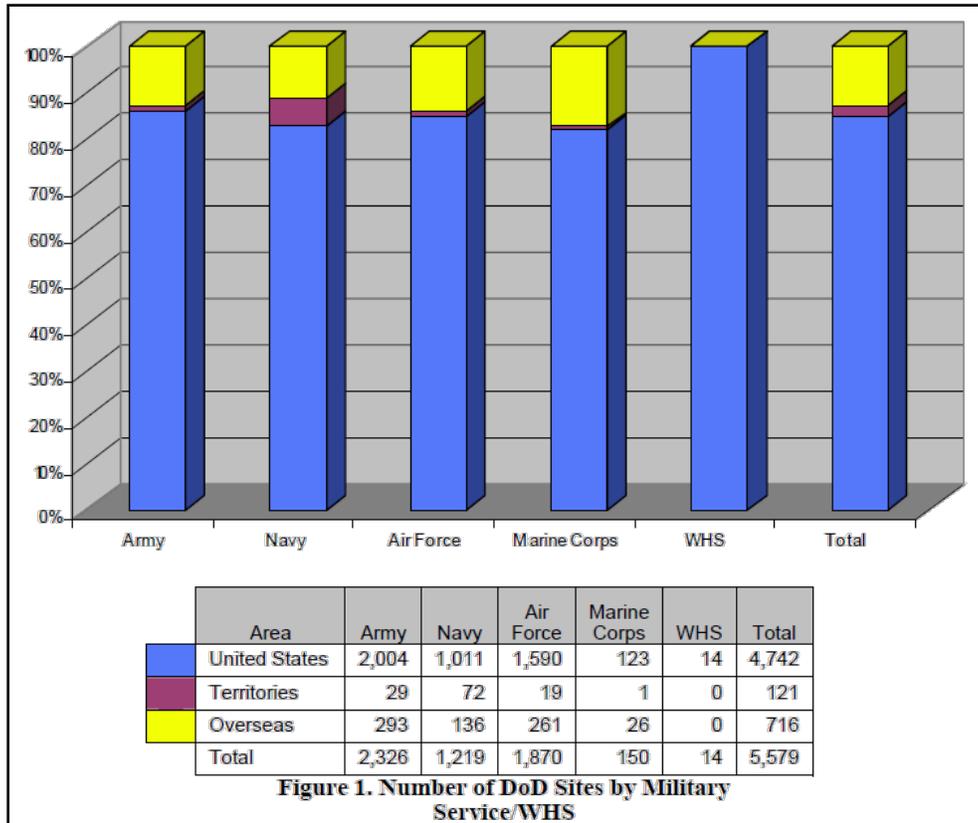
²¹ Walk, Robert. "Purple Dragons: Should the Chemical Corps Become Joint?." *Army Chemical Review* Winter 2009: 41-43. Print.

²² Ibid.

²³ Ibid.

²⁴ Department of Defense. "Base Structure Report, Fiscal Year 2009 Baseline (A Summary of DoD's Real Property Inventory)." www.defense.gov/pubs. Department of Defense, Aug 2008. Web. May 2010. <<http://www.defense.gov/pubs/pdfs/2009baseline.pdf>>

Figure 8: Geographic Distribution of Department of Defense (DoD) Sites²⁵



When the military market is specified to include the military context of DoD sites and facilities, there are 5,579 sites specifically possessed by the DoD to which the Decon Platform may be integrated within the military market. The above distribution can be further broken down as DoD sites are classified as either buildings, structures, and linear structures.²⁶

Table 7: Number of DoD Facilities by Type, Worldwide				
Geographic Area	Building	Structures	Linear Structures	Total
United States	247,209	140,953	37,854	426,016
U.S. Territories	6,381	3,331	842	10,554
Overseas	53,705	39,515	9,563	102,783
Total	307,295	183,799	48,259	539,353

²⁵ Ibid.

²⁶ Ibid.

Of the five branches of the United States military, the U.S. Army manages the largest number of DoD facilities at 242,773. This top rank is followed by the Navy (112,215), the Air Force (142,661), the Marine Corps (41,184), and the Washington Headquarters Service (WHS, 520). Ultimately, the figures outlined above provide a general framework of DoD facilities—or military context—within which the Decon Platform may find market relevance and/or market opportunity. It is within DoD buildings, structures, and linear structures that the Decon Platform may be installed for use by military end-users. Similar to varying levels of ballistic threat which may be found within deployment locales, such variation may exist within the bounds of the DoD property portfolio. That is, sites, facilities, or installations which endure an increased level of combat exposure may realize an increase in value for the Decon Platform’s fire and combat response and decontamination benefits. It is worth noting that given the connotation of ballistic threat carried by some DoD sites and facilities, or their occupants, the above market size may prove somewhat smaller as some DoD facilities may have pre-existing systems in place to defend against and mitigate fire and explosion exposure that may be CBRNe related.

In order to develop a rough estimate as to the potential market size for the Decon Platform within a military market, this assessment will assume that military bases will tend to have similar types of equipment and inventory levels for technologies employed in decontamination operations as does NSWC Crane. As such, this assessment will assume that the same number of Decon Platforms may be procured by other military bases as exist at Crane. At present, Crane has approximately 2-3 Decon Platform prototypes.²⁷ The following table articulates the number of military bases per branch, including the Coast Guard.²⁸ Overall, based on the previously established assumptions, the military market for Decon Platforms may fall between approximately 800 to 1200 units.

Table 8: U.S. Military Bases by Branch			
U.S. Military Branch	Number of Bases	Units Per Branch (2 per base)	Units Per Branch (3 per base)
Air Force	106	212	318
Army	123	246	369
Coast Guard	38	76	114
Marine Corps	37	74	111
Navy	95	190	285
Total	399	798	1197

In addition to the unit sales estimates articulated above, inventor correspondence reveals that one potential price point for the Decon Platform may be \$3,500.²⁹ Considering this price point and

²⁷ Baumgartner, Tony. DQE, Inc. Telephone correspondence 19 Aug 2011.

²⁸ "Military Bases." Militarybases.com, 2011. Web. 31 Aug 2011. < <http://militarybases.com/>>.

²⁹ Baumgartner, Tony. DQE, Inc. Telephone correspondence 19 Aug 2011.

based on the military base data above, potential revenues for the military market are articulated below:

Table 9:U.S. Military Bases by Branch and Potential Revenues Generated			
U.S. Military Branch	Number of Bases	Units Per Branch (2 per base)	Units Per Branch (3 per base)
Air Force	106	\$ 742,000	\$ 1,113,000
Army	123	\$ 861,000	\$ 1,291,500
Coast Guard	38	\$ 266,000	\$ 399,000
Marine Corps	37	\$ 259,000	\$ 388,500
Navy	95	\$ 665,000	\$ 997,500
Total	399	\$ 2,793,000	\$ 4,189,500

Based on the military base data examined and established assumptions, it appears that the Decon Platform’s military market opportunity for military bases may be between \$2.8 and \$4.2 million dollars. Note should be made that while these numbers articulate potential market opportunity, they do not necessarily reflect predictions for unit sales. A number of variables may impact unit sales such as, but not limited to, competitive products, budgetary constraints, end-user technology preferences, and perceived and real utility derived from the Decon Platform.

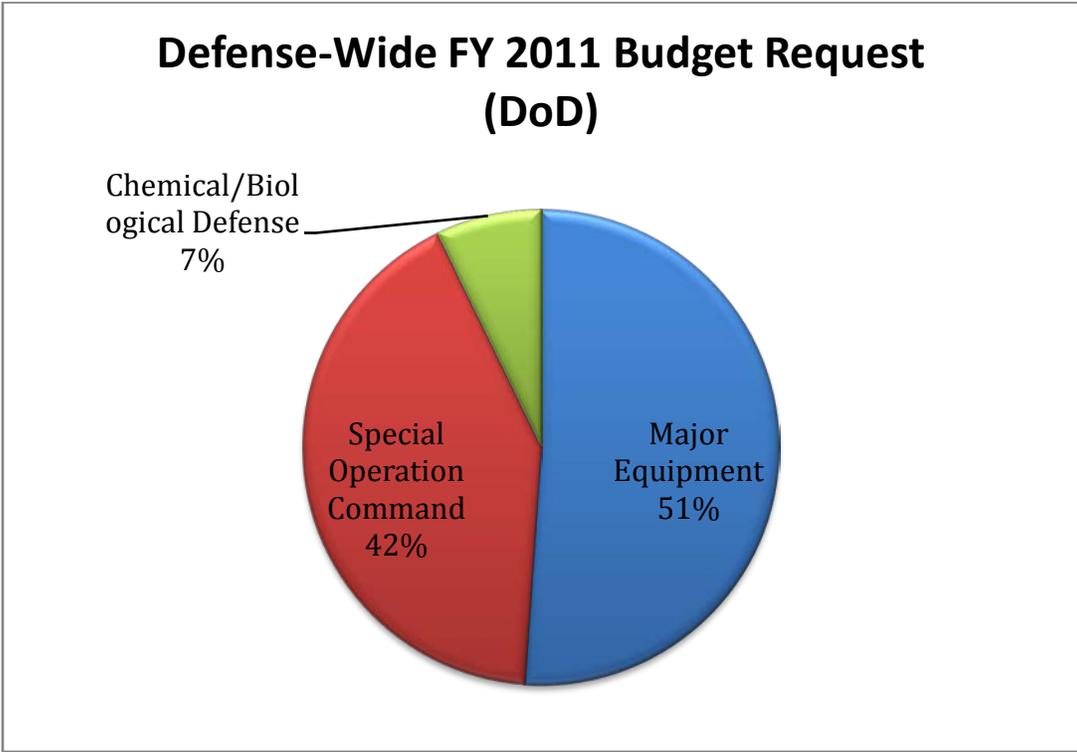
Moving forward, examining data regarding budget outlays for spending in specific areas may work to develop a more robust understanding of the size of the military market. The military allocates funds to the development and procurement of technologies such as the Decon Platform that may work to enhance decontamination efforts. Ultimately, within the military market, it may be these funds that are used to secure technologies employed in decontamination operations. Therefore, it may serve well to briefly examine funds budgeted to decontamination. The following chart and graph articulate the FY2011 President’s Budget for the Department of Defense for three major categories:³⁰

³⁰ "Department of Defense Fiscal Year (FY) 2011 Budget Estimates." *Defense Budget*. United States Department of Defense, 2011. Web.

**Table 10: Defense-Wide
FY2011 President's Budget
Base and Overseas Contingency Operations (OCO) Request
(Dollars in Thousands)
Defense-Wide**

	Base	OCO	Total	% of Defense-Wide Budget
Major Equipment	2,254,562	379,599	2,634,161	51.1%
Special Operation Command	1,655,870	494,974	2,150,844	41.7%
Chemical/Biological Defense	369,936	-	369,936	7.2%
Total	4,280,368	874,573	5,154,941	100.0%

Figure 9: Defense-Wide FY 2011 Budget Request (DoD)



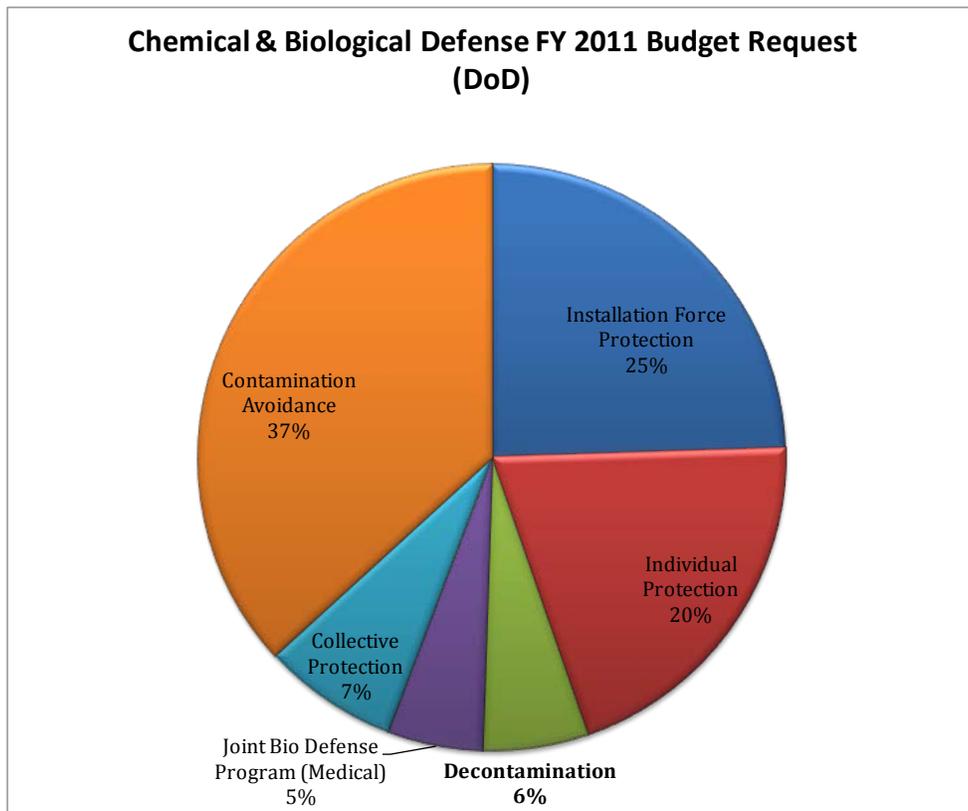
As noted within the data presented above, one category examined is that of *chemical/biological defense*. Within this segment, which comprises approximately 7.2% of the outlays examined, approximately \$370 million has been allocated to chemical and biological defense.³¹ Of the

³¹ Ibid

funds allocated to this segment, approximately 5.8%, or \$21.5 million has been directed to *decontamination*.³² Chemical and biological defense spending may be viewed in the table and chart below:³³

Table 11: Defense-Wide FY2011 President's Budget Base and Overseas Contingency Operations (OCO) Request (Dollars in Thousands) Chemical/Biological Defense (CBDP)		
	Dollars	% of Chem/Bio Budget
Installation Force Protection	90,635	24.5%
Individual Protection	74,686	20.2%
Decontamination	21,570	5.8%
Joint Bio Defense Program (Medical)	19,389	5.2%
Collective Protection	27,542	7.4%
Contamination Avoidance	136,114	36.8%
Total	369,936	100.0%

Figure 10: Chemical and Biological Defense FY2011 Budget Request



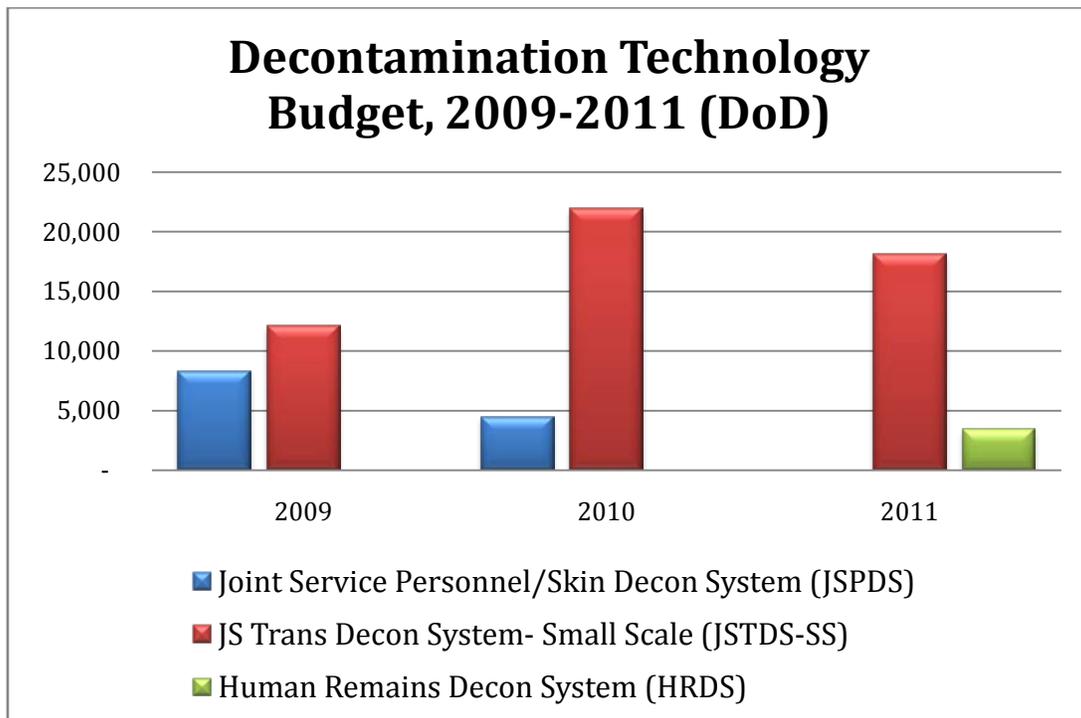
³² Ibid

³³ Ibid

Of this \$21.5 million allocated directly to military decontamination, three major procurement programs have been established to develop technologies to meet decontamination needs of the warfighter. A breakdown of these three technology procurement programs and their respective DoD dollar allocations may be found in the table and charts below:³⁴

Table 12: Defense-Wide President's Budget 2009-2011 Base and Overseas Contingency Operations (OCO) Request (Dollars in Thousands) Decontamination				
Technology	2009	2010	2011	Total
Joint Service Personnel/Skin Decon System (JSPDS)	8,280	4,466	-	12,746
JS Trans Decon System- Small Scale (JSTDS-SS)	12,124	21,940	18,160	52,224
Human Remains Decon System (HRDS)	-	-	3,410	3,410
Total	20,404	26,406	21,570	68,380

Figure 11: Decontamination Technology Budget, 2009-2011



As established above, the military market size for decontamination technologies is approximately \$21 million in 2011. Based on the previously established estimates of unit sale projections for

³⁴ Ibid

military bases, a range of 800 to 1200 Decon Platform units could conceivably be procured by the DoD. Based on a price point of \$3,500 per unit, revenues from these unit sales would range from roughly \$2.8 to \$4.2 million, or 7.5% to 13.33% of the 2011 budget for decontamination technologies. While this may represent a considerable percentage range for the overall decontamination budget in 2011, if these unit sales were spread over several years, it may be reasonable to assume that acquisition of the Decon Platform may fit within the DoD budget appetite over the next several years.

As explored, military market relevance may be ascertained via established usage of existing chemical decontamination kits. That is, historical versions of the present Decon Platform (other platforms) are currently deployed for military usage. Correspondingly, these military end-users may be identified as an established prospective market. Although existing usage does not guarantee successful market entry and/or adoption of the Decon Platform, an examination of established end-users of product predecessors may offer insight into prospective market opportunities.

Moving forward, this assessment will identify and briefly examine several factors that may influence the market for decontamination technologies within a military context.

4.1.2 U.S. Military Market Drivers and Influences

Drivers and influences within the military market may serve to impact prospective market opportunity for the Decon Platform. While this list is by no means exhaustive, potential drivers of the military market may include, but are not limited to: *military programs and investment in decontamination preparedness, military enlistment, major troop deployment, and potential chemical weapons capabilities within the global community*. Each of these factors is explored below.

Military Programs and Investments in Decontamination Preparedness

Several existing initiatives, such as those led by the *Joint Program Executive Office for Chemical and Biological Defense* (JPEO-CBD), the Joint Services' single focal point for research, development, acquisition, fielding and life-cycle support of chemical and biological defense equipment and medical countermeasures, may also work to drive growth in the U.S. military market. The JPEO-CBD defines the military challenge as the following:³⁵

- “To decontaminate personnel and equipment to reduce or eliminate the risk to personnel and to make equipment serviceable without degrading equipment or harming the environment.”

³⁵ "Joint Project Manager for Decontamination." *Joint Program Executive Office for Chemical and Biological Defense*. Defense Technical Information Center, 23 Oct 2007. Web. <<http://www.dtic.mil/ndia/2007jointcbcdip/Briefs/Olszyk.pdf>>.

To meet this challenge, the JPEO-CBD has outlined the following objectives:³⁶

Near-Term Objectives:

- Build a good strategic partnerships to focus on proper characterization of threats, operational concepts, and well defined requirements to allow technology insertion utilizing a system-of-systems approach.
- Focus science and technology and research, development, testing and evaluation efforts on decontaminants and not on mechanical engineering challenges.
- Strengthen acquisition results by executing approved acquisition strategies using incentive based contracts and performance based logistics to increase capabilities while reducing operational burdens.
- Upgrading acquisition professionalism through training, education, and personal development of the individual and the team

Mid-Term Objectives

- Leverage S&T results to upgrade fielded decontamination capabilities; begin new program starts, as appropriated. Explore strippable coatings and other non-traditional approaches.

Long-Term Objectives

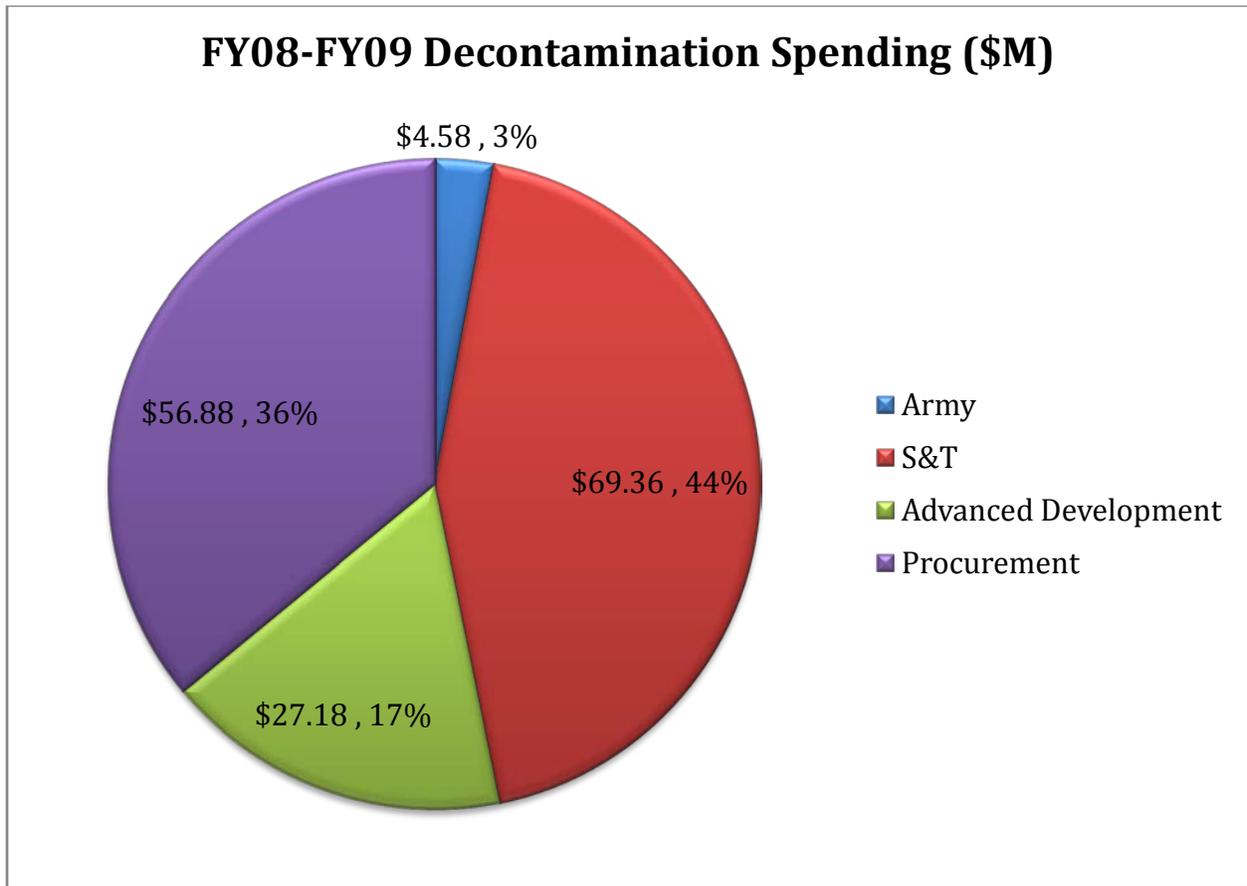
- Optimize material self-decontamination capabilities; plan spiral systems development and fielding (plug & play).

The JPEO-CBD may drive the procurement of decontamination technologies that work to enhance decontamination efforts within a military context. The following chart articulates the spending breakdown of the JPEO-CBD's FY08-FY09 Decontamination outlays (Total Decontamination spending totaled \$158 million).³⁷

³⁶ Ibid

³⁷ PPT Presentation

Figure 12: Decontamination Spending (\$M)



As the military continues to explore decontamination technologies that work to enhance the overall efficiency and effectiveness of decontamination operations, growth in this segment may be expected to sustain. That said, sustained spending on technologies that enhance decontamination efforts may be met with consideration from the end user regarding the degree to which new technologies enhance decontamination operational efficiency while fitting into the overall efficiency of military operations in within the environments for which decontamination may be necessitated. For instance, while a technology may significantly enhance the overall capabilities of decontamination efforts, it may not fit within the mobility parameters, and therefore may not fit end user overall product requirements. It is understood that a multidimensional adoption framework is employed in the evaluation of decontamination technologies, and technologies that may work to enhance decontamination efforts must fit within the parameters established by the military end-user.

Military Enlistment

As the military market has been defined via prospective end-users—enlisted and officer personnel—levels of enlistment may then serve as one potential source of market influence. As overall enlistment rises/falls, so too may the number of potential end users employing the Decon

Platform (and being trained to do so) fluctuate. With that said, the United States Bureau of Labor Statistics (BLS) estimates relatively stable levels of active-duty personnel through the year 2018. With the emergence of recent military conflicts such as Iraq and Afghanistan, consequent personnel strains may lead to increases in recruitment efforts among the armed forces in the near term.³⁸ Increased (successful) recruitment and enlistment may serve to positively influence the level of enlisted military to serve as prospective end-users of the Decon Platform.

The Bureau of Labor Statistics further estimates that in order for the armed forces to replace personnel due to retirement or completed military commitment, approximate annual recruitment will be 184,000.³⁹ This annual regeneration of enlisted personnel may also serve to constitute a potential pool of Decon Platform end users and may serve to drive the decontamination market. Conversely, new personnel may not serve as unique or nascent points of purchase as all new personnel may not receive new equipment.

Major Troop Deployments

As U.S. military forces are deployed globally, the likelihood of encountering chemical, biological, radiological and nuclear (CBRN) threats may increase due to the increased exposure to groups and individuals capable of employing said weapons. That is—the likelihood of chemical threat may increase as troops are deployed to greater number of geographic locations and especially to those locales with increased chemical warfare capacity. While the inherent nature of each conflict, and the chemical warfare agent (CWA) capabilities of each opponent, may vary, the number of detection units may be expected to be proportional to the number of deployed troops. Correspondingly, active troop deployment may provide insight into potential demand for decontamination technologies such as the Decon Platform and serve as a source of influence within the military market.

There are approximately 132,000 troops currently deployed within the Afghanistan and Iraq conflict zones. Beyond these combat initiatives, there are an estimated 194,895 troops deployed in foreign countries. Missions range from peacekeeping, to security, to military training—all of which may carry varied risk of chemical threat and/or a varied end-user value for decontamination. The map below provides a breakdown of some of the major deployments of U.S. military personnel totaling 326,895 in 2007.⁴⁰

³⁸ "Occupational Outlook Handbook, 2010-11 Edition; Job Opportunities in the Armed Forces." *Bureau of Labor Statistics*. U.S. Bureau of Labor Statistics, 07 Dec 2009. Web. May 14 2010. <<http://bls.gov/oco/ocos249.htm#outlook>>.

³⁹ *Ibid.*

⁴⁰ CNN. "CNN.com." *Major U.S. Troop Deployments*. 09 Jan 2007. CNN, Web. Mar 2010. <<http://www.cnn.com/interactive/maps/world/fullpage.troop.deployments/world.index.html>>.

Figure 13: Troop Deployment

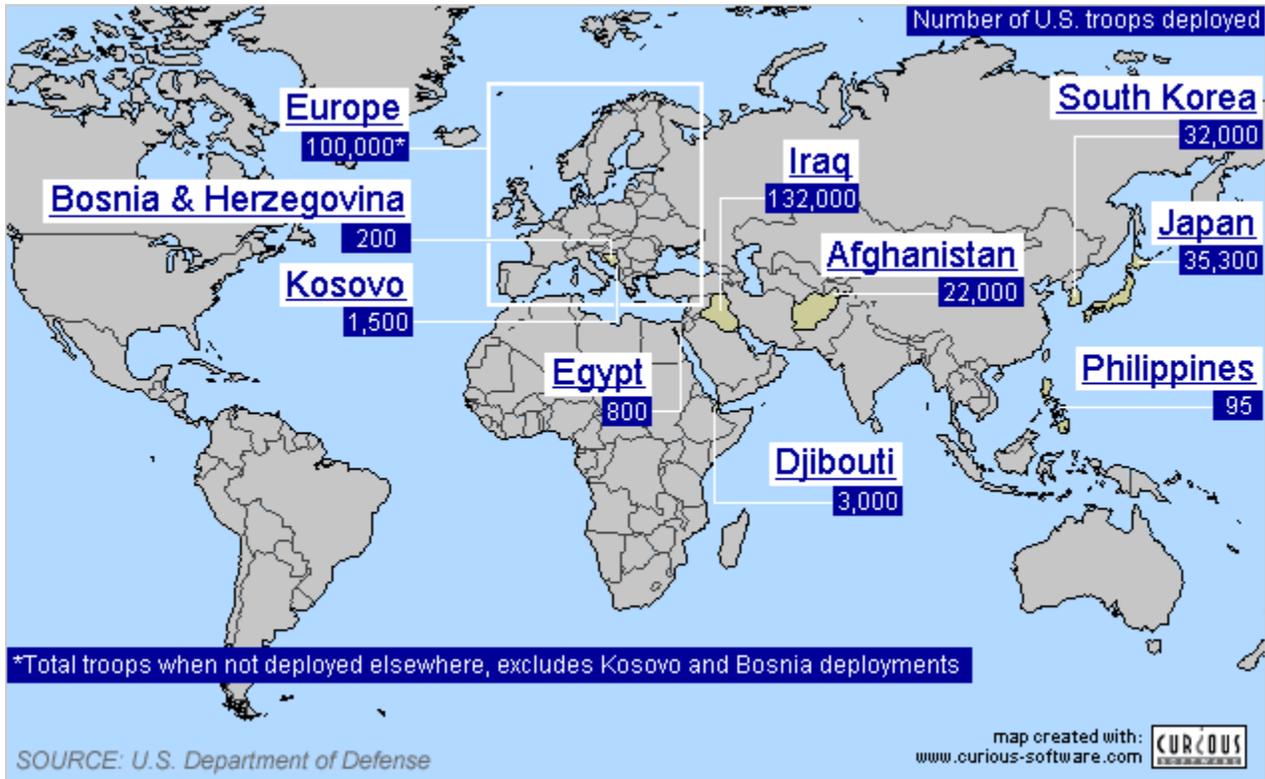


Table 13: U.S. Troop Deployment

Deployment Location	Estimated Number of U.S. Troops Deployed
Afghanistan	22,000
Bosnia & Herzegovina	200
Djibouti	3,000
Egypt	800
Europe	100,000
Iraq	132,000
Japan	35,300

Kosovo	1,500
Philippines	95
South Korea	32,000
Total	326,895

While the specific nature and motivations behind military conflict are not examined in this assessment, the number of actively deployed troops may represent a potential pool of end-users with noted value for the Decon Platform. The usefulness of this metric is further supported by the fact that utilization of the decontamination technologies by specific chemical/biological response units within the military. As seen above, those among the above outlined deployed forces who have especially relevant occupational specialties (*i.e.* CBRN defense specialists) may prove to have increased value for detection technologies such as the Decon Platform.

The 326,895 designated to be within the military context of deployed locales would not all fall under the “combat specialty operations” occupation as previously examined, so this number is certainly an overestimate, yet it provides additional data to use going forward. Similarly, those among the above outlined forces who have especially relevant occupational specialties (*i.e.* medical and combat specialty) may carry increased value for the Decon Platform’s use in decontamination operations.

Two of the most recent military engagements which have resulted in combat activities and combat casualties are Operation Iraqi Freedom (OIF) and Operation Enduring Freedom (OEF).^{41,42} Both of these military operations are categorized under the Global War on Terrorism. The Statistic Information Analysis Division (SIAD) of the Department of Defense (DoD) provides military casualty information for both of these conflicts which may shed light on casualty occurrence within the United States military market, prompting prospective market opportunity for the Decon Platform.⁴³ According to the SIAD, between October 7, 2001 and June 5, 2010, a total of 43,549 U.S. military casualties have resulted from activities associated with the Global War on Terrorism. This includes 5,473 deaths and 38,076 combat soldiers

⁴¹ Note: OEF, while focusing on casualties that occurred in Afghanistan, Pakistan and Uzbekistan also include casualties in and around Guantanamo Bay (Cuba), Djibouti, Eritrea, Ethiopia, Jordan, Kenya, Kyrgyzstan, Philippines, Seychelles, Sudan, Tajikistan, Turkey and Yemen.

⁴² Note: During the course of the writing of this report, combat troops stationed in Iraq were withdrawn on August 19, 2010.⁴² This ended the combat-oriented operations of *Operation Iraqi Freedom* and began *Operation New Dawn*, where the remaining U.S. troops intend to serve the Iraqi government at an advisory capacity.

⁴³ "Global War on Terrorism Casualty Summary by Component." *DoD Personnel & Procurement Statistics*. U.S. Department of Defense, Jun 2010. Web. 18 Jun 2010. <http://siadapp.dmdc.osd.mil/personnel/CASUALTY/gwot_component.pdf>.

wounded in action (WIA). The table below relays these figures as percentages by cause of casualty within both OIF and OEF.⁴⁴

Table 14: Global War on Terrorism Casualties, by Cause October 7, 2001 Through June 5, 2010		
Cause of Casualty	Number of Casualties	Percentage
Other/ non-weaponry	1231	2.83%
Weaponry, artillery/mortar/rocket	3,156	7.25%
Weaponry, explosive device	27,593	63.36%
Weaponry, grenade	71	0.16%
Weaponry, gunshot	4,644	10.66%
<i>Weaponry, nuclear, chemical or biological agents</i>	21	0.05%
Weaponry, other	4	0.01%
Weaponry, rocket propelled grenade	1,129	2.59%
Not reported/unknown/miscellaneous	5,700	13.09%
TOTALS	43,549	100%

While .05% or 21 casualties due to nuclear, chemical, or biological agents may represent a comparatively small percentage of the total number of casualties sustained by the U.S. military, the occurrence of these instances may perpetuate the threat of these types of incidents, thereby validating the need to be prepared for these events. That said, it is partially within these situations where the Decon Platform may find relevance, as the existence of casualties due to the exposure of harmful substances may warrant decontamination efforts for which the Decon Platform may work to enhance.

Potential Chemical Weapons Capabilities within the Global Community

The potential use and proliferation of chemical weapons remains a viable threat to the global population.⁴⁵ As the knowledge and materials required in developing chemical agents (to be used in chemical warfare) become more readily available, the threat may become more diverse and sophisticated in nature.⁴⁶ Chemical weapons capabilities around the world may serve to positively influence the military market need for chemical detection technologies. As the real or perceived threat of chemical warfare increases, so too may the level of market value or need for decontamination capacity (such as that offered by the Decon Platform) increase.

⁴⁴ "Global War on Terrorism Casualty Summary by Reason." *DoD Personnel & Procurement Statistics*. U.S. Department of Defense, Jun 2010. Web. 08 Jun 2010. <http://siadapp.dmdc.osd.mil/personnel/CASUALTY/gwot_reason.pdf>.

⁴⁵ Annual Threat Assessment, Statement Before the Committee on Armed Services United States Senate, March 10, 2009. Pg.33.

⁴⁶ Ibid

Current estimates by the United States intelligence community indicate that over twenty countries have active chemical weapons programs or capabilities.⁴⁷ The Arms Control Association (ACA), a non-partisan policy organization, sheds further light on some of the countries with chemical and biological weapons capabilities by breaking down each in terms of chemical weapons capacity and the status of their respective programs. Below is a list of select countries identified by the ACA to have said weapons capacity.⁴⁸ This information was compiled from several sources including the Defense Department, State Department, CIA, Arms Control and Disarmament Agency and the United States Army. The list of countries, while by no means exhaustive, provides insight into the prospective chemical agent threat which may prompt market value of the Decon Platform.

Table 15: Global Chemical Weapons	
Country	Potential Chemical Weapons Capabilities
China	Has an advanced chemical weapons program, including a variety of agents. Researching more advanced agents.
	Delivery systems include artillery, rockets, mortars, landmines, aerial bombs, sprayers, and short- and medium-range ballistic missiles
Egypt	Probably maintains a chemical weapons stockpile.
India	Declared in June 1997 that it possessed a chemical weapons stockpile. Has begun to destroy its chemical weapons stockpile under the CWC. Its industry will retain the ability to produce agent precursors—chemicals that can be used in chemical weapons production.
	Same potential delivery systems as for biological weapons.
Iran	Has a stockpile of chemical weapons. Previously known to have produced and stockpiled blister, blood, and choking agents and probably nerve agents. Seeking aid from Chinese and Russian entities to develop a more advanced, self-sufficient infrastructure.
	Delivery vehicles include artillery shells, mortars, rockets, and aerial bombs.
	Used chemical weapons during the Iran-Iraq War.
Iraq	Had extensive program before the Persian Gulf War under which it produced and

⁴⁷ Laljer, Charles. "Joint Chemical Agent Detector (JCAD) The Future of Chemical Agent Detection (U)." *National Defense Industrial Association* Mar 27 2000: Print.

⁴⁸ "Chemical and Biological Weapons Proliferation at a Glance." *Arms Control Association*. Arms Control Association, Sep 2002. Web. May 15 2010. <<http://www.armscontrol.org/factsheets/cbwprolif>>.

	<p>stockpiled mustard, tabun, sarin, and VX.</p> <p>Delivered chemical agents against Iranian forces during the Iran-Iraq War using aerial bombs, artillery, rocket launchers, tactical rockets, and helicopter-mounted sprayers. Also used chemical weapons against its own Kurdish population in 1988.</p> <p>Program was largely dismantled by United Nations weapons inspectors in the 1990s, but Iraq retains some chemical weapons and has begun reconstituting its chemical infrastructure since inspectors left the country in 1998. Could resume agent production within a few weeks or months but would need foreign assistance to completely restore its production capabilities to pre-Persian Gulf War levels.</p> <p>Same potential delivery systems as for biological weapons.</p>
Israel	Believed to have chemical weapons program
Libya	<p>Produced mustard and nerve agent before 1990. Still has some elements of its chemical weapons program and is working to re-establish its chemical weapons capabilities, which had been limited by UN sanctions from 1992 to 1999. Is pursuing an indigenous production capability but is highly dependent on foreign suppliers.</p> <p>Attempted to use chemical weapons against Chadian troops in 1987. Same potential delivery systems as for biological weapons.</p>
North Korea	<p>Believed to possess sizable stockpile of chemical weapons, including nerve, blister, choking, and blood agents.</p> <p>Delivery vehicles include ballistic missiles, artillery, and aircraft</p>
Pakistan	<p>Has imported chemicals that it could use to make chemical weapons agent.</p> <p>Delivery vehicles could include missiles, artillery, and aerial bombs.</p>
Russia	<p>Possesses potentially the world's largest chemical weapons stockpile: 40,000 metric tons of chemical agent, including VX, sarin, soman, mustard, lewisite, mustard-lewisite mixtures, and phosgene.⁶</p> <p>The United States believes that Russia has not declared some of its chemical agents and weapons and notified Moscow in April 2002 that it could not certify that Russia was complying with the CWC.</p> <p>Has started destroying its chemical weapons under the CWC but is not expected to complete destruction until at least 2012.</p>

	<p>Reports indicate that Moscow has worked on a new generation of chemical agents called “novichoks,” which are allegedly designed to circumvent the CWC and evade Western methods to detect and protect against chemical weapons.</p> <p>Potential delivery vehicles include artillery, bombs, spray tanks, and short-range ballistic missiles.</p>
South Korea	Possesses a chemical weapons stockpile and is destroying it under the CWC.
Sudan	Is developing the ability to produce chemical weapons, possibly including VX. Has received Iraqi assistance
Syria	Possesses sarin, which it can deliver by aircraft or ballistic missile, and is working to develop VX. Key elements of its program rely on foreign sources.
Federal Republic of Yugoslavia	Possesses weaponized CS; suspected of having un-weaponized mustard and sarin and, possibly, weaponized BZ

While it is understood that U.S. military forces do not have a presence in all of the countries listed above, the potential existence of chemical weapons programs may create sustained demand for preparedness among the U.S. military. This demand for preparedness may then support prospective military market opportunity for the Decon Platform.

4.2 U.S. Commercial Decontamination Market

4.2.1 Commercial Market Definition and Quantification

The U.S. Chemical Safety Board (CSB) is an independent federal agency that investigates chemical and industrial accidents with the objective of protecting workers, the public, and the environment. CSB investigates industrial disasters associated with chemical and general manufacturing explosions and fires.⁴⁹ At present, the CSB has completed a total of 65 investigations and is currently investigating 18 industrial disasters.⁵⁰ While the occurrence of these disasters may drive the market demand for systems that work to mitigate the damage caused in the event of such incidences, identifying and quantifying the number of industrial establishments that may experience such events may shed light on a prospective pool of end users for technologies such as the Decon Platform. In addition, two NAICS classifications for

⁴⁹ "Complete Investigations." CSB. U.S. Chemical Safety Board, 2011. Web. <http://www.csb.gov/investigations/investigations.aspx?Type=2&F_All=y>.

⁵⁰ Ibid

which the Decon Platform may hold relevance may be that of 562112, *Hazardous Waste Collection*, and 562111, *Hazardous Waste Treatment and Disposal*.⁵¹

- **Hazardous Waste Collection:** This U.S. industry comprises establishments primarily engaged in collecting and/or hauling hazardous waste within a local area and/or operating hazardous waste transfer stations. Hazardous waste collection establishments may be responsible for the identification, treatment, packaging, and labeling of waste for the purposes of transport.
- **Hazardous Waste Treatment and Disposal:** This U.S. industry comprises establishments primarily engaged in (1) operating treatment and/or disposal facilities for hazardous waste or (2) the combined activity of collecting and/or hauling of hazardous waste materials within a local area and operating treatment or disposal facilities for hazardous waste.

The chart below articulates the types of hazardous waste collection and treatment establishments in the United States and select data for each North American Industry Classification System code (NAICS).⁵²

Table 16: NAICS 56, Administrative and Support and Waste Management and Remediation Services 2007 Economic Census				
2007 NAICS code	Definition	Number of Establishments	Sales, Shipments, Receipts, Revenue, or Business Done (\$ 1,000)	Number of employees
562112	Hazardous Waste Collection	506	1,857,052	9,749
562111	Hazardous Waste Treatment and Disposal	751	5,864,136	34,444

As noted, chemical manufacturing accidents may warrant decontamination operations for both human and physical capital assets. The following table articulates selected chemical manufacturers by NAICS. As this list only suggests the type of firms that may be prepared to react to an accident, it may serve as a starting point from which a more complete view of the prospective end-user base may stem.⁵³

⁵¹ 2007 Economic Census." *U.S. Census Bureau* 15 apr 2011:. Web.

⁵² "Ibid.

⁵³ "Ibid

Table 17: NAICS 325, Select Chemical Manufacturers 2007 Economic Census

2007 NAICS code	Definition	Number of Establishments	Annual Payroll (\$ 1,000)	Number of employees
325110	Petrochemical Manufacturing	56	845,333	9,256
325120	Industrial Gas Manufacturing	576	720,258	11,446
325181	Alkalies and Chlorine Manufacturing	49	490,745	6,364
325311	Nitrogenous Fertilizer Manufacturing	156	264,209	3,920
325312	Phosphatic Fertilizer Manufacturing	80	404,627	6,264
325320	Pesticide and other Agricultural Manufacturing	241	567,481	10,155
325412	Pharmaceutical Preparation Manufacturing	963	10,366,908	159,420
325920	Explosives Manufacturing	83	311,010	6,532

Similarly to the military market quantification, this assessment will adopt several assumptions in order to develop a potential market opportunity framework for the Decon Platform. This assessment will assume that the upper limit of unit sales may be similar to that of the military market, in that 2 to 3 Decon Platform units may be employed by establishments for which decontamination efforts may be warranted, based on the nature of business operations conducted (*i.e.* petrochemical manufacturing). Note may be made that the unit projections below exist as upper bounds to unit sales projections, as a number of factors such as market penetration may ultimately impact overall unit sales. That said, based on the number of establishments according to NAICS delineations, the following chart articulates potential upper bounds of Decon Platform unit sales:

Table 18: Unit Sales for NAICS 56, Administrative and Support and Waste Management and Remediation Services 2007 Economic Census

2007 NAICS code	Definition	Number of Establishments	Unit Sales Projections (2 Units)	Unit Sales Projections (3 Units)
562112	Hazardous Waste Collection	506	1,012	1,518
562111	Hazardous Waste Treatment and Disposal	751	1,502	2,253

Table 19: Unit Sales for NAICS 325, Select Chemical Manufacturers 2007 Economic Census

2007 NAICS code	Definition	Number of Establishments	Unit Sales Projections (2 Units)	Unit Sales Projections (3 Units)
325110	Petrochemical Manufacturing	56	112	168
325120	Industrial Gas Manufacturing	576	1,152	1,728
325181	Alkalies and Chlorine Manufacturing	49	98	147
325311	Nitrogenous Fertilizer Manufacturing	156	312	468
325312	Phosphatic Fertilizer Manufacturing	80	160	240
325320	Pesticide and other Agricultural Manufacturing	241	482	723
325412	Pharmaceutical Preparation Manufacturing	963	1,926	2,889
325920	Explosives Manufacturing	83	166	249
	Total	3,461	6,922	10,383

Based on the data above, the upper limit of unit sales for the Decon Platform may range from roughly 7,000 to 10,300 units. Using these upper limits and a unit price of \$3,500, the following chart articulates associated sales revenues based on the unit sales projections above.

Table 20: Revenue for NAICS 56, Administrative and Support and Waste Management and Remediation Services 2007 Economic Census

2007 NAICS code	Definition	Number of Establishments	Unit Sales Projections (2 Units)	Unit Sales Projections (3 Units)
562112	Hazardous Waste Collection	506	\$ 3,542,000	\$ 5,313,000
562111	Hazardous Waste Treatment and Disposal	751	\$ 5,257,000	\$ 7,885,500

Table 21: Revenue for NAICS 325, Select Chemical Manufacturers 2007 Economic Census

2007 NAICS code	Definition	Number of Establishments	Unit Sales Projections (2 Units)	Unit Sales Projections (3 Units)
325110	Petrochemical Manufacturing	56	\$ 392,000	\$ 588,000
325120	Industrial Gas Manufacturing	576	\$ 4,032,000	\$ 6,048,000
325181	Alkalies and Chlorine Manufacturing	49	\$ 343,000	\$ 514,500
325311	Nitrogenous Fertilizer Manufacturing	156	\$ 1,092,000	\$ 1,638,000
325312	Phosphatic Fertilizer Manufacturing	80	\$ 560,000	\$ 840,000
325320	Pesticide and other Agricultural Manufacturing	241	\$ 1,687,000	\$ 2,530,500
325412	Pharmaceutical Preparation Manufacturing	963	\$ 6,741,000	\$ 10,111,500
325920	Explosives Manufacturing	83	\$ 581,000	\$ 871,500
	Total	3,461	\$ 24,227,000	\$ 36,340,500

Assuming that each establishment procures 2 to 3 Decon Platform units at a price of \$3,500, the upper limit for the Decon Platform market appears to be from \$24.2 to \$36.3 million. Note should be made that these revenue figures represent the upper limit of the market for the Decon Platform based on the assumptions stated previously. They do not represent expected unit sales, as a number of factors may impact the overall ability of the Decon Platform's performance in the

market. That said, there does appear to be a potential market opportunity within the commercial market for decontamination equipment such as the Decon Platform. While beyond the scope of this assessment, future commercialization plans may include focus group discussions with the professionals within the decontamination function for these NAICS segments to gauge potential market acceptance within this target market.

4.2.2 Commercial Market Drivers and Influences

Moving forward, according to the most recent National Census of Fatal Occupation Injuries, conducted by the United States Bureau of Labor Statistics (BLS), a total of 5,214 fatal workplace injuries were recorded in the United States in 2008.⁵⁴ These fatal occupation injuries include: transportation incidents, assaults and violent acts (includes homicides), contact with objects and equipment, falls, exposure to harmful substances or environments, and fires and explosions. Most relevant to an examination of potential end-user value of the Decon Platform is a subset of data examining exposure to harmful substances or environments in the work place. This data is grouped with transportation incidents resulting in worker fatality.

Transportation incidents (highway, non-highway, and pedestrians struck) constituted 2,130 of the 5,214 fatal work injuries in 2008. There were 794 assaults and violent acts in the workplace in 2008: 511 shootings, 32 stabbings, and 251 self-inflicted injuries.⁵⁵ Increasingly relevant to the Decon Platform, there were 417 workplace deaths attributed to exposure to harmful substances or environments in 2008.⁵⁶ If the established potential relationship between exposure threat and end-user value of the Decon Platform's incident response enhancement capabilities are maintained, these 417 workplace deaths due to fires and explosions may serve as a market indicator. The chart below depicts the number of fatal work injuries by type.⁵⁷

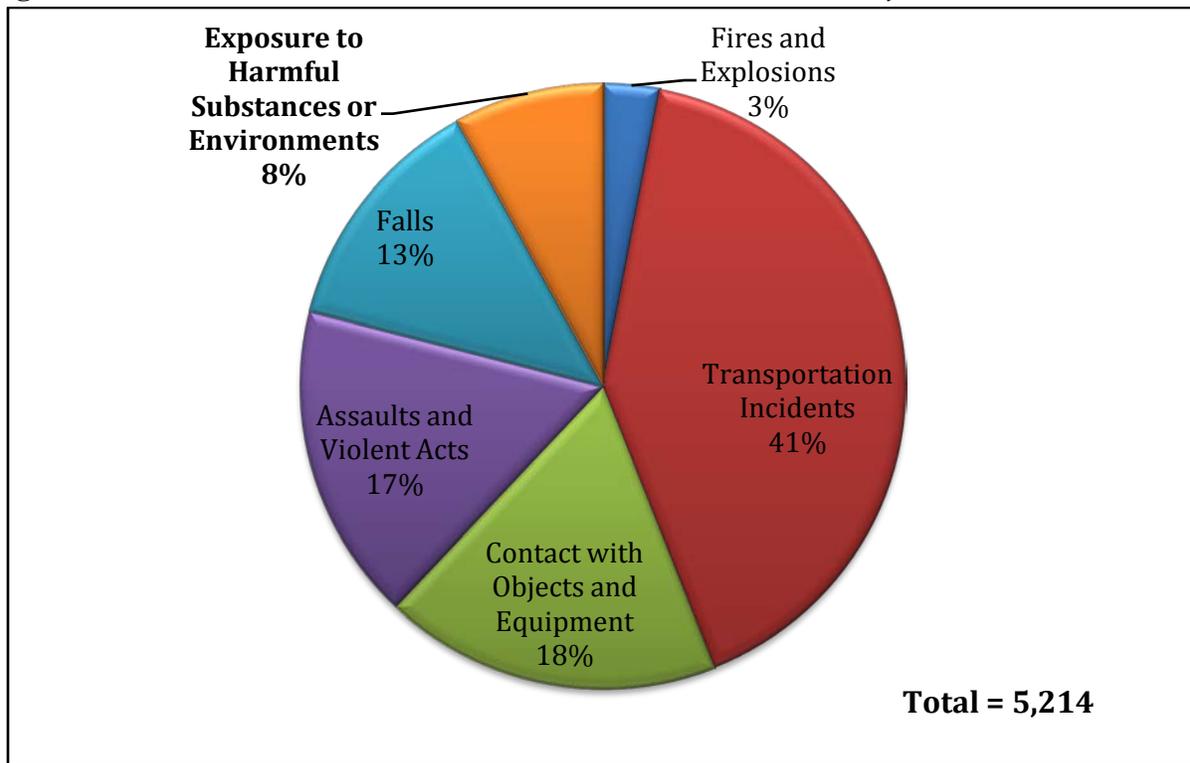
⁵⁴ Bureau of Labor Statistics, United States Department of Labor. "Number of Fatal Work Injuries." U.S. Bureau of Labor Statistics, 2010. Web. May 2010. <<http://www.bls.gov/iif/oshwc/foi/cfch0007.pdf>>.

⁵⁵ Bureau of Labor Statistics, United States Department of Labor. "NATIONAL CENSUS OF FATAL OCCUPATIONAL INJURIES IN 2008." www.bls.gov/news.release. United States Department of Labor, 20 Aug 2009. Web. May 2010. <<http://www.bls.gov/news.release/pdf/foi.pdf>>

⁵⁶ Bureau of Labor Statistics, United States Department of Labor. "Fatal occupational injuries resulting from transportation incidents and homicides by occupation, All United States, 2008." U.S. Bureau of Labor Statistics, 2010. Web. May 2010. <<http://www.bls.gov/iif/oshwc/foi/cftb0237.pdf>>.

⁵⁷ Bureau of Labor Statistics, United States Department of Labor. "Number of Fatal Work Injuries." U.S. Bureau of Labor Statistics, 2010. Web. May 2010. <<http://www.bls.gov/iif/oshwc/foi/cfch0007.pdf>>.

Figure 14: Percent Distribution, Manner in which Fatal Work Injuries Occurred: 2008⁵⁸



According to BLS statistics, the number of deaths between 2007 and 2008 and resulted from fires and explosions increased by approximately 22 deaths.⁵⁹ This was one of two categories that experienced increases in the period examined, with the other being *Contact with Objects and Equipment*, which experienced an increase in 17 deaths over the period examined.

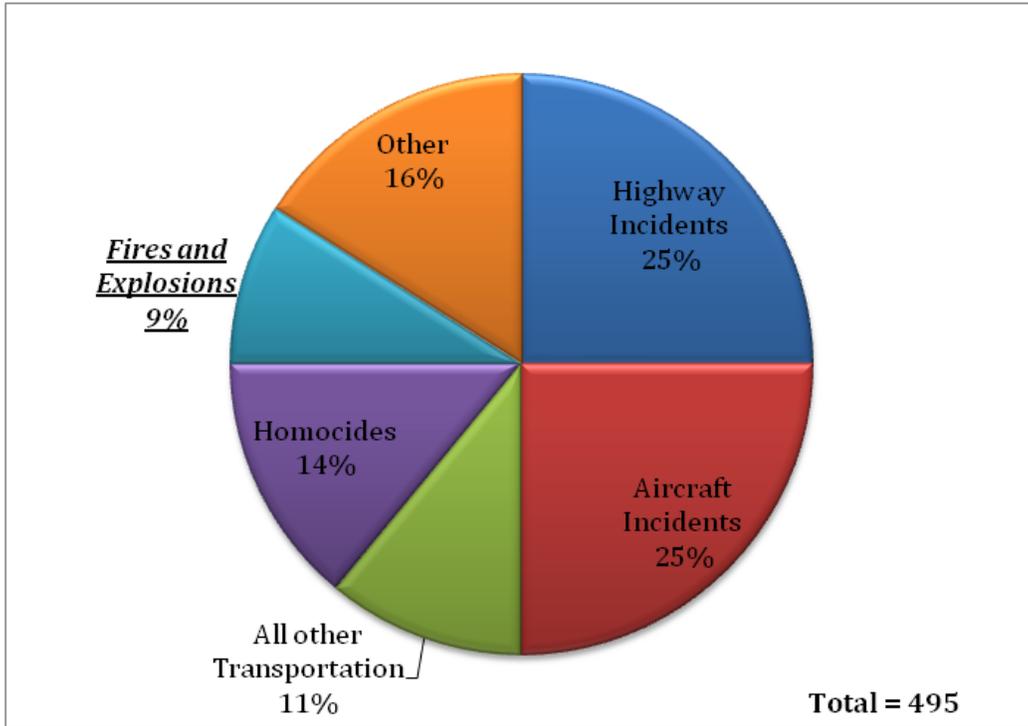
Additionally, it may be noted that in situations where there were multiple deaths, fires and explosions accounted for approximately 9% of the incidents.⁶⁰ While these incidents do not always involve harmful substances, the presence of any harmful substance may necessitate decontamination.

⁵⁸ Ibid.

⁵⁹ "Number of Fatal Work Injuries, 1992-2008." *Bureau of Labor Statistics*. Bureau of Labor Statistics, 2009. Web. < <http://www.bls.gov/iif/oshwc/foi/cfch0007.pdf>>

⁶⁰ Ibid

Figure 15: Percent Distribution, Manner in which Fatal Work Injuries Occurred in Multiple-Fatality Incidents: 2008⁶¹



Overall, the BLS reports that 90 percent of 2008's fatal work injuries involved workers in a private industry. 3,639 of the 5,214 fatalities were private sector wage and salary workers. 544 (approximately ten percent) of the fatalities were classed by the BLS to be government workers, and 1,031 to be self-employed workers. As with the ATF data discussed above, the causes and ramifications of these explosive incidents are not disclosed. Understanding that an explosion may represent a situation for which a fire suppression system may be warranted, this data may be construed to support demand for suppression systems that work to mitigate human and physical assets in such an event.

As identified above, the U.S. Chemical Safety Board (CSB) is an independent federal agency that investigates chemical and industrial accidents with the objective of protecting workers, the public, and the environment. CSB investigates industrial disasters associated with chemical and general manufacturing explosions and fires.⁶² While a full list of ongoing and completed investigations may be found on the CSB's website, examining the types of incidents that they investigate may shed light on areas for which a need for decontamination systems may exist.

⁶¹ Ibid

⁶² "Complete Investigations." CSB. U.S. Chemical Safety Board, 2011. Web. <http://www.csb.gov/investigations/investigations.aspx?Type=2&F_All=y>.

The following chart details several investigations completed by the CSB:⁶³ While the occurrence of an incident does not necessarily imply that decontamination operations were executed, the potential for an incident to occur necessitates the need for response preparedness. While first responder groups may respond to these incidents, it is understood that on-site response capabilities may exist and therefore the Decon Platform may hold relevance in the event of a chemical or industrial accident for which decontamination efforts may be required.

⁶³ Ibid

Table 22: CSB Completed Investigations

Event	Location	Date	Accident Type (If provided)	Details
Goodyear Heat Exchange Rupture	Houston, TX	11-Jun-08		On June 11, 2008, one worker was killed and approximately seven others were injured, during a maintenance operation on a heat exchanger. Ammonia overpressured inside the exchanger, causing it to rupture.
Bayer CropScience Pesticide Waste Tank Explosion	Institute, WV	28-Aug-08	Chemical Manufacturing - Fire and Explosion	Two workers were fatally injured when a waste tank containing the pesticide methomyl violently exploded, damaging a process unit at the Bayer CropScience chemical plant in Institute, West Virginia.
Xcel Energy Company Hydroelectric Tunnel Fire	Georgetown, CO	2-Oct-07	Confined Space/Asphyxiation	On October 2, 2007, five people were killed and three others injured when a fire erupted 1,000 feet underground in a tunnel at Xcel Energy Company's hydroelectric power plant in Georgetown, Colorado, located approximately 45 miles west of Denver. The fatally injured workers were trapped deep underground during an operation to coat the inside of the tunnel with epoxy using highly flammable solvents. The tunnel is several thousand feet long and connects two reservoirs with electricity-generating turbines.
Veolia Environmental Services Flammable Vapor Explosion and Fire	West Carrollton, OH	4-May-09		On May 4, 2009, flammable vapors were suddenly released into the atmosphere. The vapors found an ignition source, leading to an explosion and fire that seriously injured two workers and damaged twenty residences.

ConAgra Natural Gas Explosion and Ammonia Release	Garner, NC	9-Jun-09	Flammable Vapor	On the afternoon of June 9, 2009, 4 workers were fatally injured and dozens of others were injured when an explosion occurred at the ConAgra Foods facility in Garner, North Carolina.
Kleen Energy Natural Gas Explosion	Middletown, CT	7-Feb-10	Flammable Vapor	Six workers were fatally injured during a planned work activity to clean debris from natural gas pipes at Kleen Energy in Middletown, CT. To remove the debris, workers used natural gas at a high pressure of approximately 650 pounds per square inch. The high velocity of the natural gas flow was intended to remove any debris in the new piping. During this process, the natural gas found an ignition source and exploded.
T2 Laboratories Inc. Reactive Chemical Explosion	Jacksonville, FL	19-Dec-07	Reactive Incident	On December 19, 2007, four people were killed and 13 others were transported to the hospital when an explosion occurred at T2 Laboratories Inc. during the production of a gasoline additive called methylcyclopentadienyl manganese tricarbonyl.
Imperial Sugar Company Dust Explosion and Fire	Port Wentworth, GA	7-Feb-08	Combustible Dust Explosion and Fire	On February 7, 2008, a large explosion and fire occurred at the Imperial Sugar refinery northwest of Savannah, Georgia, causing 14 deaths and injuring 38 others, including 14 with serious and life-threatening burns. The explosion was fueled by massive accumulations of combustible sugar dust throughout the packaging building.

5 Competitive Landscape

5.1 Existing Decontamination Platforms

As a decontamination platform, the Decon Platform can be compared to several other decontamination platform technologies that are currently on the market. Some of these technologies include, but are not limited to:

- UltraDecon Deck
- Elevation Grids
- Shower Pallets
- “Milk”-style Crates
- Floor Panels and Mats

It is against these technologies that the Decon Platform may compete and be comparatively evaluated in the marketplace. It may be worth noting that the Decon Platform may have an edge over competing technologies due to its increased stability, improved portability due to folding, optional bench feature, and ease of use.⁶⁴ With that said, each of the aforementioned existing decontamination platforms are outlined below with a brief description and example provided for each. The follow table provides a brief general layout of each of the existing technologies.

⁶⁴ Potash, Daniel S. *Haz-mat Decon Platform*. DQE. Print.

Table 23: Existing Decontamination Platforms

Name	Firm	Price	Major Market Served
UltraDecon Deck ⁶⁵	Lab Safety Supply (LSS)	\$698.00 - \$2,350.00	First Responders
Elevation Grids ⁶⁶	DQE	\$102.00	First Responders
Shower Pallets ⁶⁷	First Line Technology	NA	First Responders, Military
"Milk"-style Crates ⁶⁸	Duluth	\$14.50	Not Intended for Relevant Markets
Floor Panels and Mats ⁶⁹	Hughes	NA	Industry, First Responder, Military

5.1.1 UltraDecon Deck

The Ultra Decon Deck is a stand on platform that allows first responders to stand above contaminated, hazardous materials while being decontaminated from alternative mediums. This technology can be coupled with nearly all and any decontamination shower system, as it is more than just a device to stand on, but it also allows for the contaminants to be stored in the base below the deck. The Ultra Decon Deck is used for chemical, biological, and/or radiological responses.⁷⁰ There are multiple showers with catch basins, but this one has the unique design that keeps first responders from standing in the hazardous contaminants. The figure below illustrates the UltraDecon Deck in use.

⁶⁵ "Ultra DeconDecks® Decontamination Decks | Lab Safety Supply." *Lab Safety Supply - Safety Products, Material Handling, Industrial Supply, Respirators, Safety Glasses and More!* Lab Safety Supply. Web. 22 Aug. 2011. <http://www.labsafety.com/ultra-decondecks-decontamination-decks_24537622/>

⁶⁶ "Elevation Grid | DQE." *Www.dqeready.com*. DQE. Web. 17 Aug. 2011. <<http://www.dqeready.com/productdetail.aspx?p=56>>.

⁶⁷ "Shower Pallets." *Www.firstlinetech.com*. First Line Technology. Web. 17 Aug. 2011. <<http://www.firstlinetech.com/products/decon/casualty-processing-equipment/shower-pallets/>>.

⁶⁸ "Milk Crate - Duluth Trading Company." *Www.DuluthTradingCompany.com*. Duluth Trading Co. Web. 22 Aug. 2011. <<http://www.duluthtrading.com/store/product/milk-crate-85055.aspx?src=T11WFSHP1>>.

⁶⁹ "Floor Panels and Mats." *Www.Hughes-Safety-Showers.co.uk*. Hughes. Web. 16 Aug. 2011. <<http://www.hughes-safety-showers.co.uk/2363/products/2169/floor-panels-and-mats.html>>.

⁷⁰ "Ultra DeconDeck Decontamination Showers for All Your Industrial Supply and MRO Supply Needs." *Www.spill911.com*. Spill 911. Web. 17 Aug. 2011. <<http://www.spill911.com/product/Ultra-DeconDeck,45332,2027.aspx>>



Figure 16: UltraDecon Deck⁷¹

5.1.2 Elevation Grids

The elevation grid is a made of a lightweight polypropylene material that can be placed on any surface so first responders can stand on it and out of hazardous contaminated substances. The grid, raised 5.5 inches off the ground has holes in it that allows for contaminants to pass through it and into a catch basin. Elevation Grids are specifically designed for use with the DQE Standard and Compact Collection Pools, however, note may be made that they can be used with any catch basin.⁷² The figure below illustrates an Elevation Grid.



Figure 17: Elevation Grid⁷³

5.1.3 Shower Pallets

The Shower Pallet is the most comparable of all technologies to the Decon Platform. It has a six inch rise, compact storage, and is extremely lightweight. It has porous grating which does not allow shower run-off

⁷¹ "Ultra DeconDecks® Decontamination Decks | Lab Safety Supply." *Lab Safety Supply - Safety Products, Material Handling, Industrial Supply, Respirators, Safety Glasses and More!* Lab Safety Supply. Web. 22 Aug. 2011. <http://www.labsafety.com/ultra-decondecks-decontamination-decks_24537622/>

⁷² "Elevation Grid | DQE." *Www.dqeready.com*. DQE. Web. 15 Aug. 2011. <<http://www.dqeready.com/productdetail.aspx?p=56>>.

⁷³ Ibid.

to pool at your feet, and is made of stainless steel for easy decontamination and reuse.⁷⁴ It may be noted that this technology has no moving parts and weighs about 24 pounds. Unlike the Decon Platform it can only hold up to 300 pounds at a time. It also has the capability of being used in any type of shower, on any surface. The figure below represents an illustration of the Shower Pallet.



Figure 18: Shower Pallets⁷⁵

5.1.4 “Milk”-style Crates

“Milk”-style crates have often been used as a decontamination platform because of their ease of procurement, cheap cost, and effective use for the task. Although a standard “milk”-style crate can be purchased for around \$14.50, there are downsides to using such an inexpensive and convenient item.⁷⁶ “Milk”-style crates are first of all quite small in themselves and with a person standing on one with or without protective suits, space may be limited. This creates the dangerous situation that perhaps the individual being decontaminated could possibly fall off into the decontamination run-off. Also crates offer no extra built-in stability factor. As such, extra caution and care needs to be taken when using such a device mainly because it was not built specifically for use in decontamination operations and may not provide a very safe option, as instability may lead to falls. All of the downfalls of using a crate are issues that the Decon Platform works to improve on. The figure below displays an average “milk”-style crate.

⁷⁴ "Shower Pallets." *Www.firstlinetech.com*. First Line Technology. Web. 17 Aug. 2011. <<http://www.firstlinetech.com/products/decon/casualty-processing-equipment/shower-pallets/>>.

⁷⁵ Ibid.

⁷⁶ "Milk Crate - Duluth Trading Company." *Www.DuluthTradingCompany.com*. Duluth Trading Co. Web. 22 Aug. 2011. <<http://www.duluthtrading.com/store/product/milk-crate-85055.aspx?src=T11WFSHP1>>.



Figure 19: "Milk"-style Crate⁷⁷

5.1.5 Floor Panels and Mats

Hughes makes special floor panels and mats that are designed specifically for the use with decontamination showers for the same purpose as the Decon Platform. However, these panels and mats are designed specifically for use with Hughes decontamination showers which may limit their versatility, and may in term limit their potential market size. The Decon Platform on the other hand can be used with a number of decontamination showers, thus giving it a potential edge over this product, as it may serve in many decontamination situations where shower systems may be employed. ⁷⁸The figure below illustrates Hughes Floor Panels and Mats.

⁷⁷ Ibid.

⁷⁸ "Floor Panels and Mats." *Www.Hughes-Safety-Showers.co.uk*. Hughes. Web. 16 Aug. 2011. <<http://www.hughes-safety-showers.co.uk/2363/products/2169/floor-panels-and-mats.html>>.



Figure 20: Floor Panel⁷⁹

5.2 Competitive Firms in the Industry

The following section briefly identifies and compares firms that manufacture and supply commercially-available decontamination showering hardware. All of the hardware that is assessed is considered decontamination shower hardware and thus could be paired with the Decon Platform in order to improve each firm's specific hardware item's versatility. This assessment also begins an assessment that considers the possibility of various strategic partnerships that could be formed with said firms in order to enhance their product lines and offer a more robust decontamination product offering. Not only would the firms assessed benefit from having a more complete product, but such a partnership may assist DQE in penetrating new market segments and expanding its all-around market share. The firms that are reviewed in this section include the following:⁸⁰

- Andax
- Base-X
- BioTech Systems
- Dupont
- Fend-all
- First Line Tech
- FSI North America
- Guild Associates
- HydroTherm
- Karcher
- L3 Communications
- MITI

⁷⁹ Ibid.

⁸⁰ Note: While this assessment will work to briefly review a number of firms in this section, it should be noted that this list is not exhaustive, and does not represent the entire competitive market for these products.

- Nor E
- Reeves EMS
- RFD Beaufort
- RMC Medical
- TVI

DQE may benefit from a strategic partnership formed with one or more of the firms listed above for a number of reasons. First, each firm is headquartered in a different geographic region which may provide one way that DQE could get the Decon Platform to become more visible and known in various locations, if the assumption is made that a firm may have local ties to prospective end users, in addition to potentially wider reach (national, international). Also many of these firms serve different market segments than does DQE itself (*i.e.* military). This would allow DQE to leverage existing sales channels and generate greater name recognition in markets that it currently does not serve. This may also allow the Decon Platform to be used in conjunction with hardware items typically not used by the first responder segment that DQE currently serves as a primary segment. A partnership therefore could possibly be a way for DQE to gain some market share in segments it typically does not participate in as well as spread the DQE name and brand around the U.S. and even some overseas locations. The following table is a more informative list of each of the companies identified above. While in depth analysis regarding the overall attractiveness of prospective strategic partner targets is beyond the scope of this assessment, the development of a high-level view of the market may serve to create a baseline from which further considerations may be made.

Table 24: General Information of Decontamination Firms			
Company	Location	Product Line/Services	Market Segments Served
BioTech Systems		Liquid delivery/shower system	N/A
Andax ⁸¹	Saint Marys, KS	Decon Trailers, Pacs, showers, stretchers	Haz-Mat teams, Fire Departments, Homeland Security, electric utilities, industrial facilities, municipalities, transportation companies, and the government.
Base-X ⁸²	Solon, OH	Decon Shelters, ventilaion and air filtration systems	First Responder, military, government, homeland security,

⁸¹ "Disaster Preparedness : Andax Industries." /www.andax.com. Andax. Web. 15 Aug. 2011. <<http://www.andax.com/disaster-preparedness.aspx>>.

⁸² "Base-X Shelters | Shelters | HDT Global." [Www.hdtglobal.com](http://www.hdtglobal.com). HDT Global. Web. 17 Aug. 2011. <<http://www.hdtglobal.com/products/shelters/base-xreg-shelters/>>

Kärcher ⁸³	Friedrich-List-Straße 4, Duetchland	Liquid delivery/shower system	Industry/Civilian
HydroTherm ⁸⁴	Cumming, GA	shower system	First Responder, Civillian, Military, Hospitals, Schools
L3 Communicatons ⁸⁵	New York, NY	Liquid delivery	US Government
Guild Associates ⁸⁶	Dublin, Ohio	liquid delivery, shelter, sorbent mats, decon laundry equipment	military, industry
Reeves EMS ⁸⁷	Orangeburg, NY	Decon systems, showers, shelters	First Responder, first receiver, military, law enforcement, industrial
TVI ⁸⁸	London W10 6QY, UK	decon system, pools, suits, shelters,	firefighters, rescue industry
DQE ⁸⁹	Fishers, IN	showers, collection basin, elevation grids, shelters	first responders, health care and mass care
First Line Tech ⁹⁰	Chantilly, VA	systems, shelters, shower pallets	first responder and military

⁸³ "Alfred Kärcher GmbH & Co. KG | Home." *Www.karcher.com*. Karcher. Web. 16 Aug. 2011. <<http://www.karcher.com/int/Home.htm>>.

⁸⁴ "Hydro Therm Inc. About Us." *Tridentone.com*. Trident One. Web. 17 Aug. 2011. <<http://tridentone.com/aboutus.asp>>.

⁸⁵ "About L-3." *Www.l-3.com*. L3 Communications. Web. 15 Aug. 2011. <<http://www.l-3com.com/about-l-3>>.

⁸⁶ "About Guild Associates." *Www.guildassociates.com*. Guild Associates. Web. 15 Aug. 2011. <http://www.guildassociates.com/about_us.htm>.

⁸⁷ "Reeves Decontamination Shelter and Clinical Equipment â Decontamination Options." *First Response and Paramedic EMS Equipment â Reeves EMS*. Reevesems.com, 2011. Web. 20 Aug. 2011. <<http://www.reevesems.com/Products/Decontamination.aspx>>.

⁸⁸ "TVI 2 Line Decontamination System Decontamination System | Fire Supplies - TheBigRedGuide." *Firefighting & Fire Rescue Equipment | Fire Safety News & Events - TheBigRedGuide.com*. Thebigredguide.com, 2011. Web. 18 Aug. 2011. <<http://www.thebigredguide.com/fire-products-specification/tvi-2-line-decontamination-system.html>>.

⁸⁹ "First Responder Products." *Emergency Response DQE*. Dqeready.com, 2007. Web. 17 Aug. 2011. <<http://www.dqeready.com/productsmain.aspx?Section=1>>.

⁹⁰ "Decontamination Equipment." *Welcome*. Firstlinetech.com, 2011. Web. 17 Aug. 2011. <<http://www.firstlinetech.com/>>.

FSI North America ⁹¹	Berea, OH	showers, pools, hoses, liners, bladder tanks, systems, shelters	WMD, Life Safety, Hazmat, Decontamination, Mass Casualty, Medical, EMS, and Fire Fighting
MITI ⁹²	Grand Junction, CO.	decon system, decon pool, decon hoop	first responder
Nor E ⁹³	Bellingham, WA	decon systems, trailers,	Police, fire, hospitals, military, government, Industrial
RFD Beaufort ⁹⁴	Dunmurry, N. Ireland	decon shower systems	oil and gas industry, military, marine, aerospace and homeland security markets
Dupont ⁹⁵	Willmington, DE	Protective Clothing	Industrial
Fend-all ⁹⁶	San Leandro, CA	decon shower, bladder tank, decon deck, privacy sceens and shelter, elevation grids, hoses	US Government, Military, first responders
RMC Medical ⁹⁷	Philadelphia, PA	decon shower, pool, curtains, clothing, elevation grids, hose	EMS, Fire, Hospital, Industrial

Another way that existing competitive firms in the industry can be assessed is by presenting and comparing their respective decontamination showering hardware. Comparatively evaluating each firm's hardware may allow DQE to make an educated decision on who it believes would make the best strategic partner based on the various rankings and price comparisons. Additionally, evaluating the firms' existing

⁹¹ "FSI North America." *Welcome to FSI North America*. Fsinorth.com, 2011. Web. 20 Aug. 2011. <http://www.fsinorth.com/index.php?option=com_virtuemart>.

⁹² "Hazmat Decon, First Response, Portable Decontamination." *Wheel Locks, Parks and Recreation Equipment, Parking Meters, Decontamination Equipment*. Mitico.com, 2000. Web. 18 Aug. 2011. <http://www.mitico.com/decon_hoop1_.htm>.

⁹³ "Personal Care Kits." *Nor-e*. Nor-e.com, 2011. Web. 16 Aug. 2011. <http://www.nor-e.com/decon_equipment.php>.

⁹⁴ "Your Safety and Survival Experts." *RFD Beaufort*. Www.rfdbeaufort.com. Web. 14 Aug. 2011. <<http://www.rfdbeaufort.com/>>.

⁹⁵ "DuPont.com: DuPont Overview." *DuPont. The Miracles of Science™*. Www2.dupont.com, 2011. Web. 15 Aug. 2011. <http://www2.dupont.com/Our_Company/en_US/>.

⁹⁶ "Decon Shower Accessory Bag Fend-All - Decontamination Shower Accessories - Emergency Preparedness - 3PVR6 : Grainger Industrial Supply." *Grainger Industrial Supply - MRO Supplies, MRO Equipment, Tools & Solutions*. Www.grainger.com, 2011. Web. 22 Aug. 2011. <<http://www.grainger.com/Grainger/ecatalog/N-bkeZ1z0qanh/Ntt-decon>>.

⁹⁷ "Emergency Response Decontamination Equipment." *RMC Medical - Emergency Response Decontamination Equipment*. Www.rmcmmedical.com. Web. 19 Aug. 2011. <<http://www.rmcmmedical.com/equipment.html>>.

systems may build a clearer picture regarding which firms may have systems that may be integrated into the Decon Platform to achieve optimal decontamination performance. The Department of Homeland Security's (DHS) Preparedness Directorate Office of Grants and Training has released a document entitled *Guide for the Selection of Chemical, Biological, Radiological, and Nuclear Decontamination Equipment for Emergency First Responders*, which evaluates a number of commercially available and fielded decontamination technologies such as decontamination showers and decontamination platforms. While the technologies evaluated may represent currently fielded technologies in the first responder segment, it is understood that a number of products that are currently fielded in this particular segment are also employed in both the commercial (industrial) and military segments. Furthermore, it may be assumed that the firms that manufacture and supply these technologies to the first responder market may also have supply relationships established with the military if the assumption that these technologies are employed in military contexts.

The table below displays decontamination showering hardware separated into their respective categories and appropriate ratings for each. It should be noted that this information was drawn from the March 2007 edition of the DHS's *Guide for the Selection of Chemical, Biological, Radiological, and Nuclear Decontamination Equipment for Emergency First Responders*. Please see Appendix A for the rating legends. Appendix A assigns numerical values to the visual performance indicators for the purpose of evaluating the overall attractiveness of the technologies considered. These numerical assignments are provided only as one potential mechanism against which each of the technologies may ultimately be compared, and should not be considered the *sole* measurement mechanism.

Table 25: Decontamination Shower Hardware Ratings⁹⁸

Name	Cost	Weight (lb)	Decon Process	CA Decon	BA Decon	TIMs Decon	Rad Decon	Set-up Time	Power Requirements	Durability	Environmental Conditions	Environmental Considerations	Resources	Warranty	Skill/Training
Liquid Deliver Systems															
BioTech Systems Portable Decontamination System	\$23.9K	450	☐	☐	☐	☐	☐	●	☐	☐	⊗	☐	●	☐	☐
Karcher Mediclean		84	☐	☐	☐	☐	☐	●	☐	⊗	☐	⊗	⊗	☐	●
Guild Associates	\$75	1.44	●	●	☐	☐	☐	⊗	●	☐	●	●	⊗	☐	●
Karcher Decon Sprayer DS-10		21	●	●	☐	☐	☐	●	●	⊗	●	⊗	⊗	☐	●
Karcher Decon Sprayer DS-10S		12	●	●	☐	☐	☐	●	●	⊗	●	⊗	⊗	☐	●
Karcher Deconta D2		6.6	●	●	☐	☐	☐	●	●	⊗	●	⊗	⊗	☐	●
HydroTherm TridentOne	\$1.95K	23	☐	☐	☐	☐	☐	●	●	☐	●	⊗	●	●	●
Karcher Lightweight Multi-Purpose Decontamination System		485	●	●	☐	☐	☐	☐	☐	●	●	⊗	⊗	☐	●

⁹⁸ Fatah, Alim A., Richard D. Arcilesi, Adam K. Judd, Laurel E. O'Connor, Charlotte H. Lattin, and Corrie Y. Wells. *Guide for the Selection of Biological, Chemical, Radiological, and Nuclear Decontamination Equipment for Emergency First Responders*. Rep. no. 103-06. 2nd ed. Washington, DC: Office of Grants and Training, 2007. Print.

Karcher Multi-Purpose Decontamination System		485	●	●	○	○	●	●	○	⊗	●	⊗	⊗	○	●
Karcher SCS 1801 DE		900	●	●	○	○	●	●	○	⊗	●	⊗	⊗	○	●
L3 Communications BIT BIT™ Spray Gun Decontamination System*	\$20K		○	●	●	○	○	●	○	●	⊗	●	⊗	○	●
Multipurpose Shelters	Cost	Weight (lb)	Decon Process	CA Decon	BA Decon	TIMs Decon	Rad Decon	Set-up Time	Power Requirements	Durability	Environmental Conditions	Environmental Considerations	Warranty	Skill/Training	
Reeves EMS Isolation Shelter			○	○	○	○	○	○	○	⊗	⊗	○	●	●	
Reeves EMS J Series Tactical Soft Shelter		1600	○	○	○	○	○	○	⊗	⊗	●	○	●	●	
Reeves EMS M Series Shelter System			○	○	○	○	○	○	⊗	⊗	●	○	●	●	
Reeves EMS XB Series Shelter System			○	○	○	○	○	○	⊗	⊗	●	○	●	●	
TVI Consequence Response Decontamination System	\$60.9 K	2260	○	○	○	○	○	●	○	●	⊗	○	○	●	
Guild Associates	\$6K-\$10K	120	○	○	○	○	○	●	●	○	○	○	⊗	⊗	

Decon Shower Systems																
Name	Cost	Weight (lb)	Functional Applications	Decon Process	CA Decon	BA Decon	TIMS Decon	Rad Decon	Capacity/Throughput	Set-up Time	Power Requirements	Durability	Environmental Considerations	Resources	Warranty	Skill/Training
Andax Environmental De-Con Pac™	\$1.22K	20	☐	☐	☐	☐	☐	☐	☐	●	●	☐	☐	●	☐	●
Base-X Decontamination Shelters 7010201CS	\$7.23K	63	☐	☐	☐	☐	☐	☐	⊗	●	☐	☐	☐	☐	☐	☐
Base-X Decontamination Shelters 7020302CS	\$27.8K	121	☐	☐	☐	☐	☐	☐	⊗	☐	☐	☐	☐	☐	☐	☐
Base-X Decontamination Shelters 7030303CS	\$32.2K	146	☐	☐	☐	☐	☐	☐	⊗	☐	☐	☐	☐	☐	☐	●
Base-X Hygiene Shower Kits	\$1.7K		☐	☐	☐	☐	☐	☐	⊗	●	⊗	⊗	☐	●	☐	●

BioTech Systems Portable Decontamination System	\$12K	136	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BioTech Systems Modesty Shelters (Folding Frame)	\$13.9K	125	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BioTech Systems Modesty Shelters (Inflatable)	\$12.9K	45.5	●	●	●	●	●	●	●	●	●	●	●	●	●	●
BioTech Systems Modular or Inflatable Decon Habitat	\$106K	2948	●	●	●	●	●	●	●	●	●	●	●	●	●	●
DQE Decon Privacy Corridor System	\$3.25K	29.9	●	●	⊗	⊗	●	●	⊗	●	⊗	⊗	●	⊗	●	⊗
DQE Standard Decontamination Shower System	\$2.34K	43.1	●	●	●	●	●	●	⊗	●	⊗	⊗	●	⊗	●	⊗
First Line Technology MiniFlex Decon Tent* (P,E,I)	\$9K	74.8	●	●	●	●	●	●	●	●	●	⊗	●	●	●	●

First Line Technology MidiFlex Decontamination Tent* (P,E,I)	\$107 K	110	●	●	●	●	●	⊗	●	●	●	⊗	●	●	●	●
FSI North America DAT Series Decon Showers	\$4K to \$46K		●	●	●	●	●	●	●	●	⊗	●	●	⊗	●	●
FSI North America F-SSIRT Safety Tank Showers	\$7.5K to \$16.5 K		●	●	●	●	●	●	●	●	●	●	⊗	●	●	●
MITI Hinge-Mate Decon Shower Tent	\$2.3K	10. 9	●	●	●	●	●	●	⊗	●	●	●	●	⊗	●	⊗
Nor E MEDecon Shelters* (P,E,I)	\$4.2K to \$15K	57	●	●	●	●	●	●	●	⊗	●	●	●	●	●	●
Reeves EMS 2 Lane First Response System			●	●	●	●	●	●	⊗	●	●	⊗	●	⊗	●	●
Reeves EMS 2 Lane Hospital System			●	●	●	●	●	●	⊗	●	●	⊗	●	⊗	●	●
Reeves EMS 2 Lane Tactical Hospital System			●	●	●	●	●	●	⊗	●	●	⊗	●	⊗	●	●

Reeves EMS 2 or 3 First Response System			●	◐	◑	◒	◓	◔	⊗	●	◐	⊗	●	⊗	●	●
Reeves EMS 2 or 3 First Lane Hospital System			●	◐	◑	◒	◓	◔	⊗	●	◐	⊗	●	⊗	●	●
Reeves EMS 2 or 3 Lane Tactical Hospital System			●	◐	◑	◒	◓	◔	⊗	●	◐	⊗	●	⊗	●	●
Reeves EMS 3 Lane First Response System			●	◐	◑	◒	◓	◔	⊗	●	◐	⊗	●	⊗	●	●
Reeves EMS 3 Lane Hospital System			●	◐	◑	◒	◓	◔	⊗	●	◐	⊗	●	⊗	●	●
Reeves EMS 3 Lane Tactical Hospital System			●	◐	◑	◒	◓	◔	⊗	●	◐	⊗	●	⊗	●	●
Reeves EMS Field Shower System			●	◐	◑	◒	◓	◔	⊗	●	◐	⊗	●	⊗	●	●
Reeves EMS Individual Decon System			●	◐	◑	◒	◓	◔	⊗	●	◐	⊗	●	⊗	●	●

Reeves EMS PVC Shower			<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>					
RFD Beaufort Individual Decon Shower Unit	\$3.5K	23	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
RFD Beaufort Lightweight Mass Decon Shower System	\$10K	55	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
RFD Beaufort Mass Decon Shower System	\$13K	140	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
RFD Beaufort Personal Decontaminat ion Shower Unit	\$7K	36	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					
TVI 2 Line Decontaminat ion System	\$29.9 K	434	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						
TVI 3 Line Decontamina nt System	\$33K	476	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>						
TVI 4 Line Decontaminat ion System	\$46.3 K		<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>					

TVI High Capacity Decontamination System	\$95.6K		<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>							
TVI Professional Individual Decontamination Systems	\$7.3K	107	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input checked="" type="radio"/>	<input type="radio"/>	<input type="radio"/>						

Decon Shower Hardware													
Name	Cost	Weight (lb)	Decon Process	CAS Decon	Bas Decon	TIMs Decon	Rad Decon	Set-up Time	Power Requirements	Durability	Environmental Considerations	Warranty	Skill/Training
DQE Decono Shower	\$375	16	<input type="radio"/>	<input checked="" type="radio"/>									
DQE MASCAS Decon Shower System	\$3.9K	180	<input type="radio"/>	<input checked="" type="radio"/>									
DQE Quick Response Shower System	\$1.38K	45	<input type="radio"/>	<input checked="" type="radio"/>									
DuPont Decon Shower		25	<input type="radio"/>	<input checked="" type="radio"/>									
Fend-all DeFend Emergency Decontamination Shower	\$516	35	<input type="radio"/>	<input checked="" type="radio"/>									

Karcher Field Shower		118	☐	☐	☐	☐	☐	●	●	⊗	●	●	●
Karcher Showerjet 15		118	☐	☐	☐	☐	☐	●	●	⊗	●	●	●
L3 Communications Decontamination Shower	\$30K	400	●	●	●	●	☐	●	●	●	●	☐	●
MITI DeCon Hoop	\$935	14	☐	☐	☐	☐	☐	⊗	⊗	●	●	☐	⊗
RMC MEDICAL Decon Shower	\$604	50	☐	●	●	●	●	●	●	●	●	⊗	●
Survival Hit and Run Kit 2	\$15K	750	☐	●	●	●	●	●	☐	●	●	●	●

Decon Accessories (Pools and the like)														
Name	Cost	Weight (lb)	Functional Application	Decon Process	CA Decon	BA Decon	TIMs Decon	Rad Decon	Set-up Time	Power Requirements	Durability	Environmental Considerations	Resources	Skill/Training
Guild Associates Protective Blanket	\$310	48	●	●	●	○	○	○	●	●	○	⊗	⊗	⊗
Guild Associates Sorbent Decontamination Mat	\$45	0.33	●	●	●	○	○	○	●	●	○	⊗	⊗	⊗
MITI DeCon Pool	\$1.2K	18	●	●	●	●	●	●	⊗	●	⊗	●	⊗	⊗
Nor E Decon Now Towel	\$2.85K	1 oz	●	●	●	●	●	●	⊗	●	●	⊗	●	●
RMC MEDICAL Decon Pool	\$118	11	●	●	●	●	●	●	●	●	○	●	●	●
RMC MEDICAL Disposable Decon System	\$189	8	●	●	●	●	●	●	●	●	○	●	●	●
RMC MEDICAL Hospital Decontamination Tabletop	\$2.99K	55	●	●	●	●	●	●	●	●	●	●	●	●
DQE Disposable Collection Pool	\$89	4	●	●	●	●	○	●	●	●	⊗	●	⊗	⊗

This type of assessment may give DQE a clearer picture of the market in which it is competing and shed some light on an avenue that is most fitting to penetrate the desired market segments and geographic locations. Additionally, while quantifiable comparisons may be drawn from the above charts, another potentially valuable takeaway may be the criterion against which each technology is evaluated. Perhaps a similar comparison may be employed to gain focus group feedback from potential end users regarding the functional benefits of the Decon Platform. In addition, this list of variables may further serve to develop a purchase decision framework within which prospective end-users may ultimately make their purchase decisions. Understanding this framework may serve as a guide both product and sales strategy development.

5.3 Military Specific Decontamination Technologies

While the above competitive assessment evaluates the general competitive environment of the decontamination market, it may serve well to briefly examine military operations with respect to decontamination activities. The following table articulates several technologies that are currently employed in military remote decontamination efforts. While this list may not exhaust the technologies employed by the U.S. military, it may serve to enhance this assessment's understanding of both the types of technologies employed by the military, in addition to broadening its understanding of the firms that serve the military market. A copy of the U.S. Army's Decontamination Kits, Apparatuses, and Equipment may be found in Appendix B, however the tables provided in the decontamination guide are provided below:⁹⁹ Note may be made that the technologies included below represent both detection and decontamination technologies. While it is understood that the Decon Platform may exist primarily as a technology to be employed in decontamination efforts, it is employed in a broader operational context— hazardous material detection and decontamination.

⁹⁹ "Appendix H: Decontamination Kits, Apparatuses and Equipment." *Individual Training*. United States Army, 2011. Web. . < <https://rdl.train.army.mil/soldierPortal/atia/adlsc/view/public/22662-1/FM/3-11.5/apph.htm>>.

Table 26: Existing Decontamination Platforms

Item and Description	Use	Limitations
Individual		
Decontaminating kit, skin, M291 SDK (20 kits per box)	To decontaminate your skin completely, through physical removal, absorption, and neutralization of toxic agents without long-term effects. NOTE: Use this kit for both actual combat and training purposes.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> WARNING Keep decontamination powder out of eyes, cuts, or wounds. It could slightly irritate the skin or eyes. </div> <p>The M291 is for external use only.</p>
Decontaminating kit, individual equipment, M295, IEDK	To decontaminate your chemical protective gloves, mask, hood, overboots, LCE, and weapon.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> WARNING Do not use for skin decontamination. Keep off the skin and out of wounds, eyes, and mouth. </div>
Battalion Decontamination Crew and Chemical Company		
SDS, M100. Each M100 consists of two 0.7-lb packs of reactive sorbent powder, two applicators, a carrying case, and two straps	To perform immediate decontamination of equipment, vehicles, and crew-served weapons. NOTE: Use this kit for both actual combat and training purposes.	Do not use on sensitive items. The operating temperature is -25°F to 120°F. <div style="border: 1px solid black; padding: 5px; text-align: center;"> WARNING Do not use for skin decontamination. Keep off the skin and out of wounds, eyes, and mouth. </div>
Decontaminating apparatus, power-driven, skid-mounted, multipurpose, integral, 500-gallon, M12A1 PDDA. The apparatus includes a pump unit, tank unit, and M2 water heater (all mounted on skids).	To spray decontaminating agents, STB slurries and solutions, and hot, soapy water rinses during field decontamination operations. To pump water or foam to fight fires, deice items, wash vehicles, and pump various fluids.	Do not use with defoliants, herbicides, or insecticides.

Decontamination Equipment and Materials (Continued)

Item and Description	Use	Limitations
Battalion Decontamination Crew and Chemical Company (Continued)		
Decontaminating system,	To perform operational and thorough	None

lightweight, M17 LDS, NSN 4230-01-251-8702. The M17 is a portable pump and water-heating unit for producing hot water and steam. The system incorporates a 1,580- to 3,000-gallon collapsible water tank, two wand assemblies, and connecting hoses.	decontamination of vehicles and equipment. To provide troop showers, as necessary.	
MPDS. The system includes one high-pressure hose, two high-temperature hoses, a lance-and-gun assembly, and a 3,000-gallon collapsible water tank.	To perform operational and thorough decontamination of vehicles and equipment.	None
FSDS. This system includes a pump unit and a bulk decontaminant tank. The system includes a spray bar for terrain decontamination, a deck gun for fixed-site equipment, and a spray hose.	To perform fixed-site and terrain decontamination. To perform operational and thorough decontamination of vehicles and equipment.	None

Detection Equipment and Materials

Item and Description	Use	Limitations
Paper, chemical agent, detector, M8. The paper is issued in a book of 25 sheets, perforated for easy removal. A color comparison bar chart is printed on the inside front cover.	To detect the presence of liquid V, G, and H chemical agents.	It cannot be used to detect vapors or chemical agents in water or petroleum products. It may give false readings.
Paper, chemical agent, detector, M9. The paper is issued in a 7-ounce dispenser box that contains one 30-foot roll of 2-inch-wide detector paper and plastic storage bags. The paper has an adhesive back for attaching to equipment and clothing.	To detect the presence of liquid V, G, and H chemical agents.	It cannot be used to detect vapors or chemical agents in water. It will not stick to dirty, oily, or greasy surfaces. Contamination indications cannot be read under a red light or by a color-blind soldier. The following can cause false readings: <input type="checkbox"/> Temperatures above 125°F. <input type="checkbox"/> Brake fluid. <input type="checkbox"/> Aircraft cleaning compound. <input type="checkbox"/> DS2. <input type="checkbox"/> Petroleum products. <input type="checkbox"/> Insect repellent.

Detection Equipment and Materials (Continued)

Item and Description	Use	Limitations
ACAA, M22	To detect chemical nerve agents in the air.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>WARNING Radiation hazard—contains beta emitters.</p> </div>
ACAA, M8A1. It can be vehicle-mounted, backpacked, or ground-emplaced.	To detect chemical nerve agents in the air.	<div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>WARNING Radiation hazard—contains Americium (AM241).</p> </div>
ICAM	<p>To detect nerve- and blister-agent vapors.</p> <p>To search out areas; to search and locate contamination on personnel, equipment, ship's structure, aircraft, land vehicles, buildings, and terrain; and to monitor for the effectiveness of decontamination. Can also be used for monitoring collective protection.</p>	<p>It is a point monitor only. It cannot give an assessment of the vapor hazard over an area from one position. It can only report conditions at the front of</p> <div style="border: 1px solid black; padding: 5px; text-align: center;"> <p>WARNING Beta radiation hazard.</p> </div> <p>the inlet probe.</p>
Detector kit, chemical agent, M256A1. It contains M8 detector paper for liquid agents and samplers/detectors for vapors.	To detect liquid G, V, and H chemical agents using M8 detector paper and to detect and determine the type of vapor (G, V, H, and AC) using samplers and detectors.	None
<p>Radiac set, AN/VDR-2. The instrument consists of a radiac meter with an internal sensor for obtaining dose rates during both mounted and dismantled operations. It has a second sensor housed in a probe and attached to the radiac meter with a cable and input connector.</p> <p>The radiac set uses a pre-settable, an audible, and a visual warning device integral to the radiac meter. The</p>	<p>To measure gamma radiation dose rates from 0.01 μGy/hr to 100 Gy/hr.</p> <p>To detect and display the level of beta particle dose rates from 0.1 μGy/hr to 5 cGy/hr.</p> <p>To measure, store, and display accumulated dose rates from 0.01 μGy to 9.99 Gy.</p> <p>To monitor personnel, supplies, and equipment.</p>	None

system is air-transportable and organic to all units.		
Computer indicator, radiac, CP696/PDR-75; detector, radiac/ DT236/PDR-75; radiac set, AN/PDR-75	To measure the accumulated neutron and gamma radiation dose recorded by the DT236. A person who may become exposed to radiation from tactical nuclear weapons wears the DT236 on his wrist.	None

Detection Equipment and Materials (Continued)

Item and Description	Use	Limitations
Radiac set, AN/UDR-13	Measures gamma radiation only and provides total dose or dose rate. It will replace the IM-93/UD dosimeter.	None
DOD biological sampling kit	Provides presumptive identification for a limited number of biological agents.	Not to be used as single means of identification. The sampling kit should never be used for diagnostic purposes.
ADM-300	Detects, measures, and digitally displays dose and dose rate levels of beta and gamma radiation.	None
Water testing kit, M272	Detects and identifies CW agents in raw or treated water sources.	None

In addition to the above technologies currently fielded by the U.S. military, the DoD budget has allocated procurement dollars for chemical and biological decontamination technologies to support in decontamination efforts. As discussed in the military market section of this assessment, the following technologies are currently being procured by the U.S. DoD.

Table 27: Defense-Wide President's Budget 2009-2011 Base and Overseas Contingency Operations (OCO) Request (Dollars in Thousands) Decontamination				
Technology	2009	2010	2011	Total
Joint Service Personnel/Skin Decon System (JSPDS)	8,280	4,466	-	12,746
JS Trans Decon System- Small Scale (JSTDS-SS)	12,124	21,940	18,160	52,224
Human Remains Decon System (HRDS)	-	-	3,410	3,410
Total	20,404	26,406	21,570	68,380

- The Joint Service Personnel/Skin Decontamination System (JSPDS) is a Food and Drug Administration (FDA) cleared individually carried skin decontamination kit. The JSPDS provides the Warfighter the ability to decontaminate the skin, after exposure to Chemical/Biological (CB) warfare agents, in support of immediate and thorough personnel decontamination operations. Reactive Skin Decontamination Lotion (RSDL) provides the Warfighter with improved capability over the existing M291 Skin Decontaminating Kit (SDK) to reduce lethal and performance degrading effects of Chemical Warfare agents.¹⁰⁰
- JS Trans Decon System- Small Scale (JSTDS-SS): The self-contained Joint Service Transportable Decontamination System – Small Scale (JSTDS-SS) is a solution when pressurized liquids are needed for speedy decontamination applications in harsh operating conditions. The JSTDS-SS consists of an applicator and accessories for conducting operational and thorough decontamination of non-sensitive military material, limited facility decontamination at logistics bases, airfields (and critical assets), naval ships, ports, key command and control centers, and other fixed facilities that have been exposed to CBRN warfare agents/contamination and toxic industrial materials.¹⁰¹
- Human Remains Decon System (HRDS): Used for evacuation of contaminated remains within theater and decontamination of the remains at the mortuary affairs collection point.¹⁰²

Table 28:Defense-Wide President's Budget 2009-2011 Base and Overseas Contingency Operations (OCO) Request Suppliers	
Technology	Supplier(s) ¹⁰³
Joint Service Personnel/Skin Decon System (JSPDS)	Bracco Diagnostics, Inc.
JS Trans Decon System- Small Scale (JSTDS-SS)	DRS Technologies (Main) MODEC, Inc Engineered Air Systems, Inc.
Human Remains Decon System (HRDS)	Teledyne Brown Engineering

¹⁰⁰ "Joint Service Personnel Skin Decon System." *Individual Training*. United States Army, 2011. Web. . <<https://jacks.jpeocbd.army.mil/Jacks/Public/FactSheetProvider.aspx?productId=315>>.

¹⁰¹ "Joint Service Transportable Decontamination System -Small Scale(JSTDS-SS)." *Products and Services*. DRS Technologies, 2010.

¹⁰² "Joint Project Manager for Decontamination." *Joint Program Executive Office for Chemical and Biological Defense*. Defense Technical Information Center, 23 Oct 2007. Web. <<http://www.dtic.mil/ndia/2007jointcbcdip/Briefs/Olszyk.pdf>>.

¹⁰³ "Department of Defense Fiscal Year (FY) 2011 Budget Estimates." *Defense Budget*. United States Department of Defense, 2011. Web.

As noted previously, one commercialization option may be to establish some form of strategic partnership with a firm that already has a foot in either the military or commercial sector markets. The above firms have established relationships with the U.S. military and have already secured supplier contracts for their respective technologies. DRS, in particular, may be a firm that could represent an attractive target. A recently acquired subsidiary of Finmeccanica Company (acquired in 2008)¹⁰⁴, DRS has existing global supply channels reaching into a number of industries including military decontamination technologies, globally. While it is beyond the scope of this assessment to evaluate the ease of partnership establishment with such firms, a first step towards the development of commercial partnerships may be to evaluate the competitive power of firms that may represent strategic partners. That said, there appears to be a number of firms that may represent attractive partners based on a number of variables including competitive position and existing sales channels into strategic segments.

¹⁰⁴ "Open Target." *The Economist*. The Economist Newspaper Limited, 2011. Web.

6 Conclusion

The Decon Platform works to enhance hazardous decontamination capabilities of personnel in situations where mass decontamination may be necessitated in response to a hazardous material incident. Although currently commercialized technologies work to serve decontamination efforts by providing raised platforms to be employed in the decontamination process, the Decon Platform may offer an alternative platform technology that works to enhance the overall effectiveness and efficiency of decontamination operations. The Decon Platforms then strives to offer the prospective advantages tabulated below:

Table 29: Decon Platform Prospective Advantages	
Prospective Advantage	Description
Increased stability and safety	The larger area of the grate, the stability rail, and the seat all may increase stability and safety.
Durable	The platform is made of aluminum which is resistant to weather and hazardous materials.
Expedited decontamination process	The larger grate area may allow for one responder to begin entering the platform while another is exiting, which cannot currently be done. This may expedite the decontamination process.
Portable	Wheels have been integrated into the design of the platform, and it is made of lightweight aluminum, which may allow for one or two person deployment.
Easy to store and deploy	The platform, including the bench and the rail, collapses into a flat configuration with all pieces locking together, making it easy to store. The system is also easy to set up.

Prospective advantages of the Decon Platform may constitute a source of product differentiation and competitive advantage. Relative to currently commercialized platform technologies, the Decon Platform may serve to enhance the overall decontamination process by offering a technology that works to create efficiencies by providing a more robust platform onto which additional decontamination technologies may be integrated. As the Decon Platform is further developed and market adoption ensues, articulating the prospective advantages tabulated above

and framing them in such a way that aligns with prospective end user purchase parameters, competitive ability may be strengthened.

As previously noted, several potential go-to-market needs may be addressed including:

- Deciding on point of sale physical configuration of the Decon Platform (*i.e.* will the platform enable seamless integration of a shower system)
- The need for further qualitative and quantitative research including, but not limited to
 - Feedback from demonstrations and focus groups
- Identification of potential strategic partnership targets
- Clear product positioning, and pricing strategy development

With this in mind it may be noted that while there are a number of currently commercialized technologies that work to serve as decontamination platforms, the existence of a strong competitor in the form of crates may indicate that currently commercialized “decontamination platforms” do not effectively offer additional benefits to prospective end users sufficient to trigger industry-wide adoption. That said, the Decon Platform may fit well within the decontamination platform segment, as existing plans consider the capability of integrating entire decontamination systems into the Decon Platform’s design. Ultimate adoption may hinge largely on the overall value that the Decon Platform provides. Offering a technology to the market that enables “decontamination system” (*i.e. shower systems, etc.*) integration into the Decon Platform may work to enhance the *overall* decontamination process, thereby warranting adoption by prospective end users.

Based on the data examined, the military decontamination market may warrant strategic consideration for initial market entry. Military spending has been revealed to be a key driver in the overall decontamination market, and future spending on the development and procurement of technologies employed for decontamination purposes is expected to continue over the near term. Additionally, technologies that are portable and may be seamlessly integrated into military operations, minimizing operational disruption, may be attractive technologies for this end user segment. Within the military market, this assessment has established upper bounds of unit sales to range from 800 to 1,200 units, with \$2.8 to \$4.2 million in resulting revenues at a unit price of \$3,500 per unit.

Correspondingly, the commercial market may represent a larger opportunity, but may be met with a number of entrance hurdles. Based on data examined, the upper bounds of the commercial market may range from \$24.2 to \$36.3 million for the Decon Platform, assuming that unit sales range from roughly 7,000 to 10,300. That said, factors such as market penetration rates may drive down unit sales and therefore generated revenue, further minimizing the potential opportunity that may exist within this segment.

Ultimately, the Decon Platform appears technologically viable. That said there appears to be a market for decontamination technologies like the Decon Platform. Adoption may rely heavily on the final design of the product and its ability to offer capabilities greater than that of currently commercialized decontamination platforms. As noted, offering a solution that enables decontamination system integration may be one point of consideration, as the decontamination process enhancements that are provided may warrant procurement of a platform that is significantly more expensive than a product like the milk crate, but which offers little benefit beyond existing as a raised platform.

Appendix A: Ratings Scale for Comparative Product Evaluation Chart

Decontamination Process

This selection factor describes the type of process used by the equipment for decontamination operations. The three process areas are chemical (i.e., neutralization of hazard using reactive

Decontamination Process		
	5	Capable of thermal, chemical neutralization, and physical removal of contaminants
	4	Capable of chemical neutralization, and physical removal of contaminants
	3	Capable of chemical neutralization but not physical removal of contaminants
	2	Capable of physical removal but not chemical neutralization of contaminants
	1	Not capable of thermal, chemical neutralization, and physical removal of contaminants or not applicable
	0	Not specified

decontaminate solutions), physical (i.e., hazard removal using sorbents, washing, encapsulation), and thermal (i.e., hazard removal using heat) applications.

Chemical Agents Decontaminated

This selection factor describes the number and types of CAs decontaminated by the equipment. Chemical agents, when referred to in this guide, are primarily nerve agents such as GB and VX, and vesicants such as HD. Blister agents considered in this guide include HN, L, and HL mixtures. Blood agents and choking agents are included within the list of TIMs. CAs are discussed in section 2.

CAs Decontaminated		
	5	Decontaminates most known CAs
	4	Decontaminates multiple CAs
	3	Decontaminates one CA
	2	Has capacity to decontaminate CAs
	1	Decontaminates no CAs or not applicable
	0	Not specified

Biological Agents Decontaminated

This selection factor indicates the number and types of BAs decontaminated by the equipment. BAs include threats such as bacterial spores (i.e., *Bacillus anthracis*—anthrax), rickettsiae (i.e., *Rickettsia typhus*—Typhus), toxins (i.e., botulinum toxin), and viruses (i.e., variola major—smallpox). BAs are discussed in section 2.

BAs Decontaminated		
	5	Decontaminates all BAs
	4	Decontaminates multiple BAs
	3	Decontaminates one BA
	2	Has capacity to decontaminate BAs
	1	Decontaminates no BA or not applicable
	0	Not specified

Toxic Industrial Chemicals/Toxic Industrial Materials Decontaminated

This selection factor describes the number and types of TICs/TIMs decontaminated by the equipment. TICs/TIMs are discussed in section 2.

TICs/TIMs Decontaminated		
	5	Decontaminates all TICs/TIMs listed
	4	Decontaminates multiple TICs/TIMs
	3	Decontaminates one TIC/TIM
	2	Has capacity to decontaminate TICs/TIMs
	1	Decontaminates no TICs/TIMs or not applicable
	0	Not specified

Radiological/Nuclear Agents Decontaminated

This selection factor describes the number and types of radiological/nuclear agents decontaminated by the equipment. Radiological agents, when referred to in this guide, refer to gamma, alpha, and beta particles. Radiological particulates can be in solid, dust, or liquid form. Radiological/nuclear agents are discussed in section 2.

Radiological/Nuclear Agents Decontaminated		
	5	Decontaminates all radiological/nuclear agents listed (not radionuclide specific)
	4	Decontaminates many radiological/nuclear agents listed (not radionuclide specific)
	3	Decontaminates one type of radiological/nuclear agents (radionuclide specific)
	2	Has capacity to decontaminate radiological/nuclear agents
	1	Decontaminates none of the radiological/nuclear agents listed or not applicable
	0	Not specified

Capacity/Throughput

This selection factor indicates the number of personnel (skin and personal equipment), large (i.e., vehicles), and small equipment (i.e., communication equipment, computers, etc.), and the areas within an infrastructure that can be decontaminated in a specific time (per hour).

Capacity/Throughput		
	5	>500 personnel; 20 large or 100 small pieces of equipment; or 10000 ft ² of area
	4	Between 100 to 499 personnel; 10 to 19 large or 50 to 99 small pieces of equipment; or 5000 ft ² to 9999 ft ² of area
	3	Between 50 to 99 personnel; 5 to 10 large or 25 to 49 small pieces of equipment; or 2500 ft ² to 4999 ft ² of area
	2	Less than 49 personnel; 4 large or 24 small pieces of equipment; or 2500 ft ² of area
	1	Not applicable
	0	Not specified

Set-up Time

This selection factor indicates the amount of time required to ready the equipment for decontamination operations. The time includes set-up, processing, and tearing down the equipment.

Set-up Time		
	5	<5 min for set-up
	4	>6 min to 10 min for set-up
	3	>11 min to 20 min for set-up
	2	>21 min to 60 min for set-up
	1	Not applicable
	0	Not specified

Power Requirements

Power requirements are the type of power (ac, dc, etc.) required to operate a piece of equipment.

Power Requirements		
	5	Power not required
	4	Battery
	3	Battery and/or ac power and/or vehicle
	2	Other power sources such as diesel engines, electrical generators, etc.
	1	Self-contained
	0	Not specified

Durability

Durability describes ruggedness of the equipment (i.e., how well a piece of equipment can take rough handling or harsh environments) and any use/reuse capabilities of the equipment (i.e., apparatus can be cleaned and reused with minimal effort, some components need replacing, apparatus cannot be cleaned and reused/sacrificial).

Durability		
	5	Able to operate with rough handling in all environments (hardened construction) and can be reused with minimal effort (can be decontaminated)
	4	Able to operate with rough handling in all environments but can only be reused after extensive cleanup and maintenance
	3	Not able to operate with rough handling but can be reused with minimal effort (multiple components need replacement after use and decontamination)
	2	Not able to operate with rough handling and can only be reused after extensive cleanup and maintenance
	1	Designed to be disposable or cannot be cleaned
	0	Not specified

Operational Environment

This selection factor describes the type of environment required for the decontamination system to be used optimally. For example, some decontamination systems are capable of operating in a field under common outdoor weather conditions and climates, i.e., rain, snow, extreme temperatures, humidity, etc. However, other decontamination systems may require more controlled conditions.

Operational Environment		
	5	Operates in all expected environments
	4	Operates in most environments
	3	Operation is restricted to certain environments
	1	Operates only at room temperature
	0	Not specified

Environmental Considerations

This selection factor refers to the type of environmental issues that arise when using a piece of decontamination apparatus (e.g., hazardous waste generation, waste disposal).

Environmental Considerations		
	5	Operation does not impact surrounding environment
	4	System is equipped with retaining structure to prevent environmental impact
	3	Not dangerous for transport (no DOT regulations)
	2	MSDS is available
	1	Could potentially impact surrounding environment—system does not provide a means to mitigate impact
	0	Not specified

Resources

Resources are the amount of manpower required to use a decontamination system (i.e., mixing, applying, and rinsing), supplies that the decontamination apparatus uses during operation and storage (i.e., batteries, filters, sensors, compressed gases), and any additional equipment required to operate the primary unit.

Resources		
	5	One individual required to use the decontamination system; no additional equipment required to operate the primary unit
	4	2 people required to use the decontamination system; 1 or more equipment items (i.e., batteries) required to operate the primary unit
	3	3 people
	2	4 people
	1	More than 4 people required to use the decontamination system; more than 2 equipment items (i.e., batteries) required to operate the primary unit
	0	Not specified

Warranty

This selection factor indicates the length of time the equipment is warranted by the manufacturer.

Warranty		
	5	>5 yr
	4	>2 yr to 3 yr
	3	>1 yr to 2 yr
	2	<1 yr
	1	Not applicable
	0	Not specified

Skill Level/Training Requirements

This factor refers to the skill level and training required for the operation of a decontamination system. Of specific interest is the amount of time required to instruct the operator to become proficient in the operation of the equipment.

Skill Level/Training Requirements		
	5	No special skills or training required
	4	No special skills but training (less than <8 h) required
	3	No special skills but training (more than >8 h) required
	2	Special skills required and training required
	1	Technician required to operate equipment
	0	Not specified

Appendix B: Decontamination Kits, Apparatuses, and Equipment

Appendix H

DECONTAMINATION KITS, APPARATUSES, AND EQUIPMENT

1. Background

[Table H-1](#) lists the decontamination equipment and materials, and [Table H-2](#) lists detection equipment and materials. Various materials and equipment are used in decontamination operations. Some are simple to use and are readily available to personnel. Others are very complex to use and are available only to specially trained teams.

Table H-1. Decontamination Equipment and Materials

Item and Description	Use	Limitations
Individual		
Decontaminating kit, skin, M291 SDK (20 kits per box)	To decontaminate your skin completely, through physical removal, absorption, and neutralization of toxic agents without long-term effects. NOTE: Use this kit for both actual combat and training purposes.	<div style="border: 1px solid black; padding: 5px; margin-bottom: 5px;"> <p style="text-align: center;">WARNING Keep decontamination powder out of eyes, cuts, or wounds. It could slightly irritate the skin or eyes.</p> </div> <p>The M291 is for external use only.</p>
Decontaminating kit, individual equipment, M295, IEDK	To decontaminate your chemical protective gloves, mask, hood, overboots, LCE, and weapon.	<div style="border: 1px solid black; padding: 5px;"> <p style="text-align: center;">WARNING Do not use for skin decontamination. Keep off the skin and out of wounds, eyes, and mouth.</p> </div>
Battalion Decontamination Crew and Chemical Company		
SDS, M100. Each M100 consists of two 0.7-lb packs of reactive sorbent powder, two applicators, a carrying case, and two straps	To perform immediate decontamination of equipment, vehicles, and crew-served weapons. NOTE: Use this kit for both actual combat and training purposes.	Do not use on sensitive items. The operating temperature is -25°F to 120°F.

		WARNING Do not use for skin decontamination. Keep off the skin and out of wounds, eyes, and mouth.
Decontaminating apparatus, power-driven, skid-mounted, multipurpose, integral, 500-gallon, M12A1 PDDA. The apparatus includes a pump unit, tank unit, and M2 water heater (all mounted on skids).	<p>To spray decontaminating agents, STB slurries and solutions, and hot, soapy water rinses during field decontamination operations.</p> <p>To pump water or foam to fight fires, deice items, wash vehicles, and pump various fluids.</p>	Do not use with defoliants, herbicides, or insecticides.

Table H-1. Decontamination Equipment and Materials (Continued)

Item and Description	Use	Limitations
Battalion Decontamination Crew and Chemical Company (Continued)		
Decontaminating system, lightweight, M17 LDS, NSN 4230-01-251-8702. The M17 is a portable pump and water-heating unit for producing hot water and steam. The system incorporates a 1,580- to 3,000-gallon collapsible water tank, two wand assemblies, and connecting hoses.	<p>To perform operational and thorough decontamination of vehicles and equipment.</p> <p>To provide troop showers, as necessary.</p>	None
MPDS. The system includes one high-pressure hose, two high-temperature hoses, a lance-and-gun assembly, and a 3,000-gallon collapsible water tank.	To perform operational and thorough decontamination of vehicles and equipment.	None
FSDS. This system includes a pump unit and a bulk decontaminant tank. The system includes a spray bar for terrain decontamination, a deck gun for fixed-site equipment, and a spray hose.	<p>To perform fixed-site and terrain decontamination.</p> <p>To perform operational and thorough decontamination of vehicles and equipment.</p>	None

Table H-2. Detection Equipment and Materials

Item and Description	Use	Limitations
Paper, chemical agent, detector, M8. The paper is issued in a book of 25 sheets, perforated for easy removal. A color comparison bar chart is printed on the inside front cover.	To detect the presence of liquid V, G, and H chemical agents.	It cannot be used to detect vapors or chemical agents in water or petroleum products. It may give false readings.
Paper, chemical agent, detector, M9. The paper is issued in a 7-ounce dispenser box that contains one 30-foot roll of 2-inch-wide detector paper and plastic storage bags. The paper has an adhesive back for attaching to equipment and clothing.	To detect the presence of liquid V, G, and H chemical agents.	It cannot be used to detect vapors or chemical agents in water. It will not stick to dirty, oily, or greasy surfaces. Contamination indications cannot be read under a red light or by a color-blind soldier. The following can cause false readings: <ul style="list-style-type: none"> • <input type="checkbox"/> Temperatures above 125°F. • <input type="checkbox"/> Brake fluid. • <input type="checkbox"/> Aircraft cleaning compound. • <input type="checkbox"/> DS2. • <input type="checkbox"/> Petroleum products. • <input type="checkbox"/> Insect repellent.

Table H-2. Detection Equipment and Materials (Continued)

Item and Description	Use	Limitations
ACAA, M22	To detect chemical nerve agents in the air.	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>WARNING Radiation hazard—contains beta emitters.</p> </div>
ACAA, M8A1. It can be vehicle-mounted, backpacked, or ground-emplaced.	To detect chemical nerve agents in the air.	<div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 0 auto;"> <p>WARNING Radiation hazard—contains Americium (AM241).</p> </div>
ICAM	To detect nerve- and blister-agent vapors.	It is a point monitor only. It cannot give

	To search out areas; to search and locate contamination on personnel, equipment, ship's structure, aircraft, land vehicles, buildings, and terrain; and to monitor for the effectiveness of decontamination. Can also be used for monitoring collective protection.	an assessment of the vapor hazard over an area from one position. It can only report conditions at the front <div style="border: 1px solid black; padding: 5px; text-align: center;">WARNING Beta radiation hazard.</div> of the inlet probe.
Detector kit, chemical agent, M256A1. It contains M8 detector paper for liquid agents and samplers/detectors for vapors.	To detect liquid G, V, and H chemical agents using M8 detector paper and to detect and determine the type of vapor (G, V, H, and AC) using samplers and detectors.	None
Radiac set, AN/VDR-2. The instrument consists of a radiac meter with an internal sensor for obtaining dose rates during both mounted and dismounted operations. It has a second sensor housed in a probe and attached to the radiac meter with a cable and input connector. The radiac set uses a pre-settable, an audible, and a visual warning device integral to the radiac meter. The system is air-transportable and organic to all units.	To measure gamma radiation dose rates from 0.01 μ Gy/hr to 100 Gy/hr. To detect and display the level of beta particle dose rates from 0.1 μ Gy/hr to 5 cGy/hr. To measure, store, and display accumulated dose rates from 0.01 μ Gy to 9.99 Gy. To monitor personnel, supplies, and equipment.	None
Computer indicator, radiac, CP696/PDR-75; detector, radiac/ DT236/PDR-75; radiac set, AN/PDR-75	To measure the accumulated neutron and gamma radiation dose recorded by the DT236. A person who may become exposed to radiation from tactical nuclear weapons wears the DT236 on his wrist.	None

Table H-2. Detection Equipment and Materials (Continued)

Item and Description	Use	Limitations
Radiac set, AN/UDR-13	Measures gamma radiation only and provides total dose or dose rate. It will	None

	replace the IM-93/UD dosimeter.	
DOD biological sampling kit	Provides presumptive identification for a limited number of biological agents.	Not to be used as single means of identification. The sampling kit should never be used for diagnostic purposes.
ADM-300	Detects, measures, and digitally displays dose and dose rate levels of beta and gamma radiation.	None
Water testing kit, M272	Detects and identifies CW agents in raw or treated water sources.	None

2. Decontamination Devices for Personnel

Decontamination devices for personnel are the warfighter's first defense against contamination on the skin. They are an integral part of immediate decontamination.

a. M291 SDK.

(1) Users: All services and components.

(2) Description. The M291 kit ([Figure H-1](#)) consists of six identical packets that contain a mixture of activated resins. This resin mixture adsorbs and neutralizes liquid chemical agents present on an individual's skin and neutralizes agents. The mixture consists of an adsorbent resin, a resin containing sulfonic acid, and a hydroxylamine-containing resin. The black powder residue will provide a visual confirmation of the thoroughness of application and will not cause any skin irritation even after prolonged contact with skin. However, normal precautions must be observed so that the powder does not enter open wounds, the mouth, or the eyes. This kit will also be used for training; no training aid will be produced. The issue is 20 M291 SDKs per box.

(3) Mission. The M291 is used to decontaminate the skin, mask hood, and protective gloves. After masking, the individual opens a packet from the kit, removes the applicator pad, and applies an even coating of resin powder while scrubbing the entire skin area suspected to be contaminated.

(4) Capabilities. One applicator pad will decontaminate both hands and the face if necessary. If the face must be decontaminated, the neck (including the throat area) and the ears must also be decontaminated using a second applicator pad. The black powder resin will provide a visual confirmation of the thoroughness of application and will not cause any skin irritation even after prolonged contact with skin.



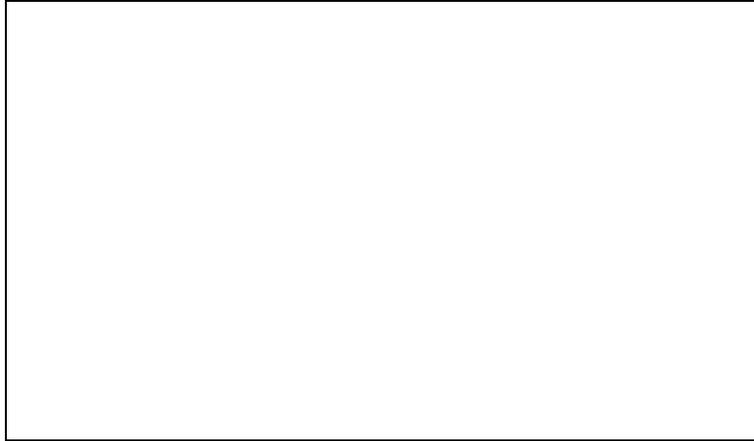


Figure H-1. M291 Skin Decontamination Kit

b. RSDL.

(1) Users. All services and components.

(2) Description. RSDL is a broad-spectrum liquid CW agent decontaminant that will remove and destroy military chemical agents on contact. After CW agent destruction, RSDL leaves a nontoxic residue that may be washed off with water. It does not need to be removed immediately. RSDL is safe for use on all intact skin surfaces and for limited duration use in the eyes. RSDL reacts rapidly, providing the full removal and destruction of CW agents within 2 minutes, enabling efficient decontamination of casualties. The RSDL kit is fielded with three kits per package.

(3) Mission. The RSDL is used to decontaminate intact skin only. It is impregnated in a sponge pad and packaged as a single unit in a heat-sealed foil pouch. When exposed to CW agents, the user wipes the exposed skin with the lotion.

(4) Capabilities. RSDL acts within seconds of being applied to the skin, neutralizing the toxicity of chemical agents by breaking down their molecules. Apply the lotion within 1 minute of contamination. The lotion is effective against cutaneous nerve and blister agents, such as mustard, GB, and VX.

3. Decontamination Devices for Equipment

Decontamination devices are used for all levels of equipment decontamination (e.g., immediate, operational, and thorough).

a. M295 IEDK.

(1) Users. All services and components.

(2) Description. The M295 kit (see [Figure H-2](#)) provides a means to decontaminate individual equipment through physical removal and absorption of chemical agents, with no long-term harmful side effects. The M295 consists of four individual wipe-down mitts—each enclosed in a protective packet. Each wipe-down mitt consists of a decontaminating powder contained within a pad material. When used, the sorbent powder from the mitt flows freely through the pad material. The M295 allows for the decontamination of individual equipment, such as gloves, footwear, weapon, helmet, and LBE through physical removal and sorption of chemical agents. The residue of the powder shows where the powder has been used or, more importantly, what areas have not been decontaminated.



6.1.1.1 Figure H-2. M295 IEDK

(3) Mission. The M295 kit is used to decontaminate the individual's personal equipment (i.e. protective gloves, mask, hood, NBC overboots, helmet, LBE, and weapon). Each packet consists of a decontamination mitt filled with 22 grams of the decontaminant compound, 20 M295 kits are packed in a fiberboard-shipping container.

b. M100 SDS.

(1) Users: All services and components.

(2) Description. The M100 SDS ([Figure H-3](#)) uses a reactive sorbent powder to remove and neutralize chemical agents from surfaces. The use of the M100 SDS decreases decontamination time and eliminates the need for water. Each M100 SDS consists of two 0.7-pound packs of reactive sorbent powder, two wash mitt type sorbent applicators, a case, straps, and detailed instructions. An optional chemical-resistant mounting bracket is also available. The sorbent decontamination system provides a simple, rapid, and efficient system to decontaminate small and individual issue items. The sorbent is used during the operator's wipe-down portion of immediate decontamination on surfaces that personnel must touch or contact to operate the equipment, such as door handles, crew-served weapons, etc. The sorbent powder is applied to the mitt or flat surfaces prior to decontaminating. The M100 SDS is not classified as a hazardous material and, therefore, can be shipped through normal transport processes.

(3) Mission. The M100 replaces the M11/M13 DAP and associated decontamination solution number 2 (DS2) used in operator wipe down (immediate decontamination) with a reactive, neutralizing sorbent powder.



Figure H-3. M100 SDS

4. Power-Driven Decontamination Systems

Power-driven decontamination systems provide a myriad of decontamination capabilities to the warfighter. The most significant capability of these systems is their ability to dispense high-pressure water for the physical removal of contamination.

a. M17 LDS.

(1) Users. USA, USMC, and USAF.

(2) Description. The M17 is a portable decontamination system. It consists of a 7.3-horsepower engine (Figure H-4), a self-priming pump for drawing and pressurizing water, a fan assembly to deliver combustion air to the heater, a water heater with a coil of tubing 90 feet (27.45 meters) long, a self-priming pump for the heater fuel system, and a small generator to supply electricity for ignition and safety control functions. The M17 LDS includes diesel and gas fuel-powered systems.

(3) Mission. The M17 dispenses high-volume, low-pressure, hot or cold water for the removal of gross contamination. It is used to support operational decontamination missions.

(4) Capabilities. The M17—

(a) Is transportable by a 3/4-ton trailer, 5/4-ton cargo trucks, cargo aircraft, and helicopters (sling load).

(b) Provides pressurized water at temperatures up to 248°F (119.88°C) at a rate of up to 9 gallons (34.06 liters) per minute.

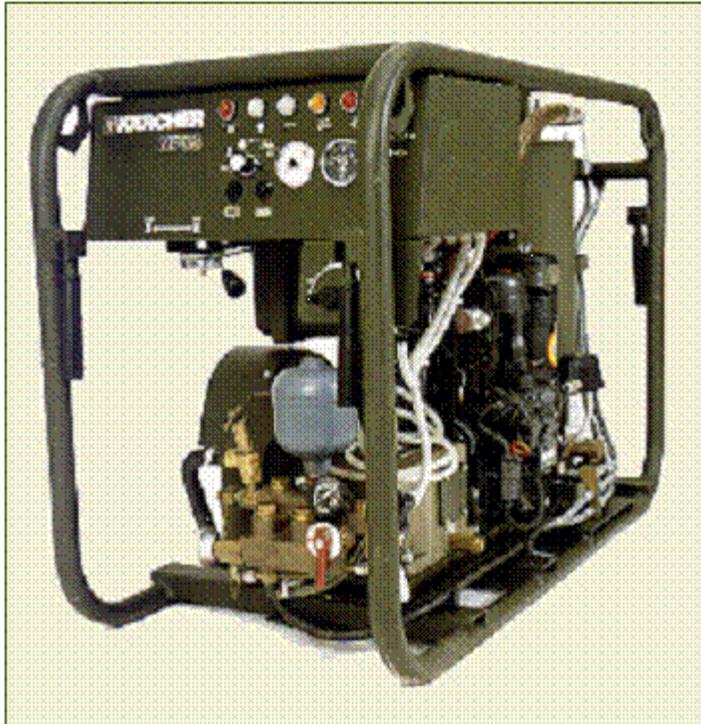
(c) Draws water from a natural source up to 30 feet (9.15 meters) away and 9 feet (2.75 meters) below pump level. There is an additional 3,000-gallon (113.55 hectoliter) water storage tank in the event a natural source of water is not available.



Figure H-4. M17 LDS

b. Multipurpose Decontamination System.

- (1) Users. USA.
- (2) Description. The MPDS ([Figure H-5](#)) is a lightweight, modular decontamination system.
- (3) Mission. The MPDS decontaminates material with aqueous solutions in support of operational or thorough decontamination operations.
- (4) Capabilities. The MPDS provides—
 - (a) Material decontamination with aqueous solutions or hot-foam treatment.
 - (b) Equipment decontamination with dry steam.
 - (c) Personnel decontamination by supplying warm water to shower systems.
 - (d) Multiple operating modes: cold water, hot water, steam, and dry steam.
 - (e) Engine winter start capability to -30°C (-22°F).
 - (f) Self-priming, high-pressure pump for water intake from all water sources, including seawater.
 - (g) Water flow and pressure that are infinitely adjustable.
 - (h) Automatic protection against calcification.
 - (i) Single fuel system.



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6.1.1.1.1 Figure H-5. MPDS

c. M12A1 Power-Driven Decontamination Apparatus.

(1) Users. USA.

(2) Description. The M12A1 consists of a 500-gallon tank, a pumper unit, and an M2 water heater. Each unit is mounted on a skid base. Power for operating the equipment is supplied by the pump unit, which uses a 20-horsepower military standard gasoline or diesel engine to drive a centrifugal pump and a 28-volt direct current generator. The M2 water heater is electrically connected through a main power cable to a generator in the pump unit. A personnel shower assembly stowed on the tank unit in disassembled form can be readily assembled in varying configurations to shower up to 24 personnel at one time.

(3) Mission. The M12A1 is used to support thorough, operational, and terrain decontamination missions.

(4) Capabilities. The M12A1—

(a) Is used to spray water, STB slurry, and other decontaminants.

(b) May be used for firefighting and spraying water.

d. Fixed-Site Decontamination System (FSDS).

(1) Users. USA.

(2) Description.

(a) The FSDS ([Figure H-6](#)) is a compressed-air, foam-generating system, consisting of a pump and bulk decontaminant tank that can be mounted on a commercial vehicle or trailer. The system may be used in three different modes: a spray bar is mounted at the rear of the trailer for terrain decontamination, a deck gun is mounted in the truck bed for fixed-site equipment and facility decontamination, and a foam dispensing nozzle with a 100-foot spray hose is mounted on the trailer for direct decontaminant application and to supplement deck gun operations.

NOTE: Decontaminant in “foam” form is not authorized for use at this time. DF 200 is currently approved for CENTCOM use only.



Figure H-6. FSDS Placed in a Civilian Vehicle

(b) The systems primary decontaminant is DF 200.

(3) Mission. The primary function of the FSDS is to provide a decontamination capability for APODs and SPODs. The system also provides the capability to perform decontamination on main supply routes (MSRs), vehicles, equipment, and aircraft. Inherent in the mission to decontaminate APODs and SPODs is the requirement to decontaminate staging areas, runways, roads, buildings, and container expresses (CONEXs). Each of these areas requires different approaches, configurations, and planning factors. (See paragraph 5 for the TTP to support FSDS operations.)

(4) Capabilities. The FSDS provides—

- Mobile terrain decontamination.
- Fixed-site and facility decontamination.
- Equipment decontamination.

5. Fixed-Site Decontamination System Tactics, Techniques, and Procedures

Three individuals (supervisor, driver, and spray cannon/wand operator) man the system. The system has three modes of operation: spray bar at the rear of the trailer, deck gun on the truck bed, and 100-foot spray hose on the trailer. Only one mode of operation is possible at one time. To decontaminate horizontal surfaces (staging areas, docks, and roads) the rear spray bar is the primary mode of operation. To decontaminate buildings, structures, and

containers, the deck gun is the primary mode. The spray hose will be used to augment the deck gun and also will be available for smaller areas, vehicles, and aircraft and to perform self-decontamination of the system.

The primary decontaminant is DF 200. DF 200 is supplied as a three-part solution: Part A, Part B and Part C activator. The system is configured with a trailer that contains three separate storage tanks for the solution. There are two 500-gallon tanks, one each for Parts A and B, and a 30-gallon tank for Part C. Tank C pours directly into Tank B so activation occurs prior to mixing of Parts A and B. Tank C should be released prior to movement in order for Parts B and C to get mixed well. The system mixes the solutions as it operates and, therefore, premixing of the solutions is not required. The system can be filled and standing ready without the need to perform the loading after the mission is received. This allows for a quick response when a mission must be performed.

a. Mission Receipt.

(1) The planner determines the surface composition of the contaminated area in order to determine the effects on the mission (i.e., absorption and desorption rate, reaction of surface with decontaminant, concerns of contaminant transfer due to uncontrolled runoff).

(2) The planner determines the extent of the contamination in order to identify the quantity of required decontamination applicators. [Table H-3](#) identifies the capability of one system with a 1,000-gallon load of DF 200. The planner also determines the extent of the contamination, which will determine the resupply quantities required.

Table H-3. Typical Mission Parameters (1,000 gallons of DF 200)

Contaminated Areas	Time	Speed	Coverage
Roads, runways, and staging areas	18 minutes	2–3 mph	25,000 square feet

(3) The planner identifies any additional requirements (i.e., additional pumps, detectors, and nonstandard equipment).

(4) The planner assesses the weather conditions (temperature, precipitation, and winds) and determines how they may affect the mission. The assessment will also evaluate whether the mission must be adjusted based on the conditions. For example, extreme heat may cause the contaminant to dissipate faster than a thorough decontamination operation can be completed, so a limited area may be decontaminated to maintain operations until weathering effects are complete.

(5) The planner determines the entry and exit routes. The locations of the routes depend on factors such as the locations of the contamination and the threat. Additionally, multiple start points may be used because two FSDSs can be used at the same time.

(6) The planner determines support requirements (e.g., engineer, logistical, security, and other assets) needed to safely complete the mission.

b. Mission Preparation.

(1) Dispatch resupply vehicles, and coordinate the supply linkup location.

(2) Determine IPE requirements, and request resupply quantities of all IPE and other expendable items and equipment.

c. Precombat Checks.

(1) Individual Equipment. Inspect IPE, to include M40 protective mask and filter, BDO or JSLIST, overboots, gloves, wet-weather gear, and TAP aprons.

(2) FSDS. Conduct preventive-maintenance checks and services (PMCS), and fill fuel and decontaminant tanks. Load Tank A with Solution A, or load Tank B with Solution B, and fill Tank C with the fortifier. Ensure that the washer fluid reservoir is topped off, and load extra wiper fluid and wiper blades. Also ensure that wet wipes are on board for the gunner to use to wipe DF 200 residue off his protective mask eye lenses.

(3) Weapons. Ensure that all individual and crew-served weapons are serviceable and that ammunition has been issued to all personnel.

(4) Communications System of the FSDS. Ensure that PMCS has been performed on all communications systems. Obtain call signs and frequencies, and load communications security into all systems. If nonsecure communication devices are used (handheld, etc.), make communications checks with all personnel. Radios must have earpieces and microphones that can operate under the mask hood. The primary communications contact in a vehicle must be the driver; the vehicle commander, once dismounted, will not have access to interior communications systems.

(5) Convoy Route. Brief all personnel on the convoy route and the type of road march to be conducted.

(6) Support Requirements. Ensure that any external support elements are integrated into the mission (e.g., security).

(7) Coordination. Although the FSDS has the ability to decontaminate itself, decontamination support may have to be coordinated to ensure that the FSDSs are decontaminated thoroughly upon completion of the assigned mission in preparation for subsequent missions.

d. Mission Execution.

(1) As the systems depart the starting point, the fortifier in Tank C will be released into Tank B. During the convoy, the fortifier will be thoroughly mixed with Solution B. When the squad reaches the RP, the DF 200 will be ready for decontamination operations.

(2) Upon arrival at the identified site, the FSDS supervisor will direct the driver to stop prior to entering the contaminated area and will start the FSDS in the trailer. Once the supervisor and the spray operator exit the vehicle and the mission starts, they will not reenter the vehicle until the unit has been decontaminated. They should don either TAP aprons or wet-weather gear prior to entering the contaminated area.

(3) The FSDS will proceed down the road/MSR at approximately 2 to 3 miles per hour while the spray bar dispenses DF 200. The driver will place the vehicle in four-wheel drive, low and allow the vehicle to move while idling.

(4) Any obstacles encountered while conducting spray operations (vehicles, debris, etc.) will also be sprayed with decontamination solution so that they may be safely removed after the contamination has been neutralized. The operator at the system controls may have to stop the vehicle, turn off the spray bar, and spray this equipment with the hose or deck gun. If two systems are available, one may be used to spray the equipment and obstacles while the second is used to spray surfaces.

(5) The contamination will be approached from the upwind direction, and the area will be decontaminated in 10-foot-wide slices. Multiple systems may work in tandem, each covering a 10-foot swath, ensuring that the swaths overlap and result in full coverage. Since the system operates at a slow speed (2 to 3 mph), the driver must maintain close attention to the trailer. If the spray pattern does not overlap, the contamination will remain. The slow speed increases the time it takes to return to the correct pattern. For example, [Figure H-](#)

7 indicates two systems conducting terrain decontamination.

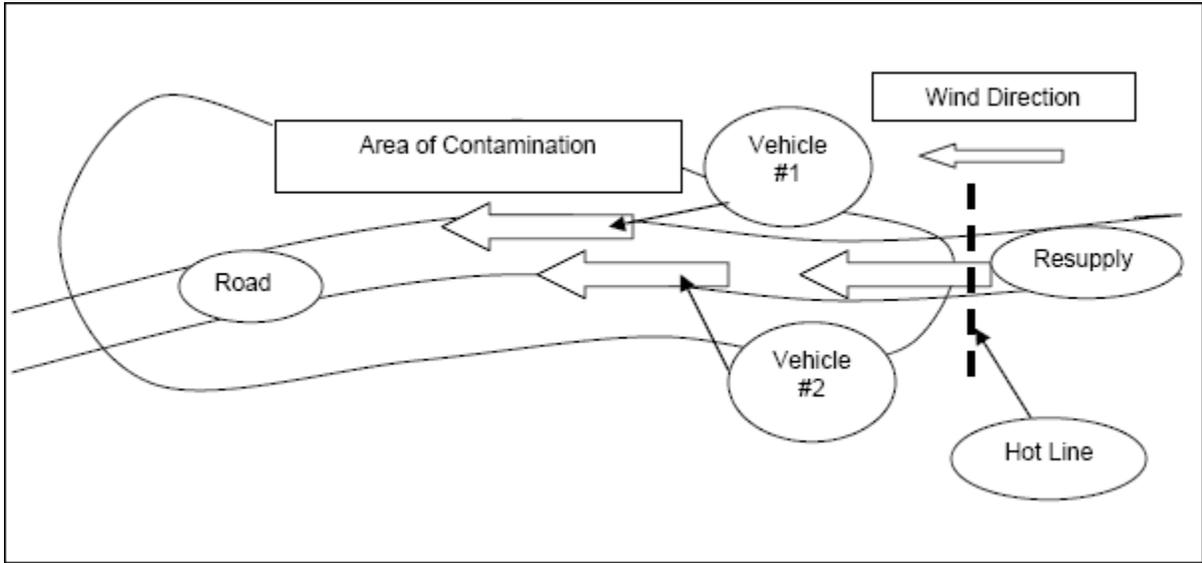


Figure H-7. Two FSDSs Conducting Terrain Decontamination

(a) When operating in tandem, the drivers must ensure that spray patterns overlap. Driving the low speed required can cause the vehicle to drift, and if full overlap is not obtained, the area not covered must be resprayed. The vehicle supervisor or gunner should walk alongside the vehicle as it proceeds and ensure that overlap occurs by communicating the progress to the driver. [Figure H-8](#) shows FSDS operations conducting terrain decontamination operations that overlap.

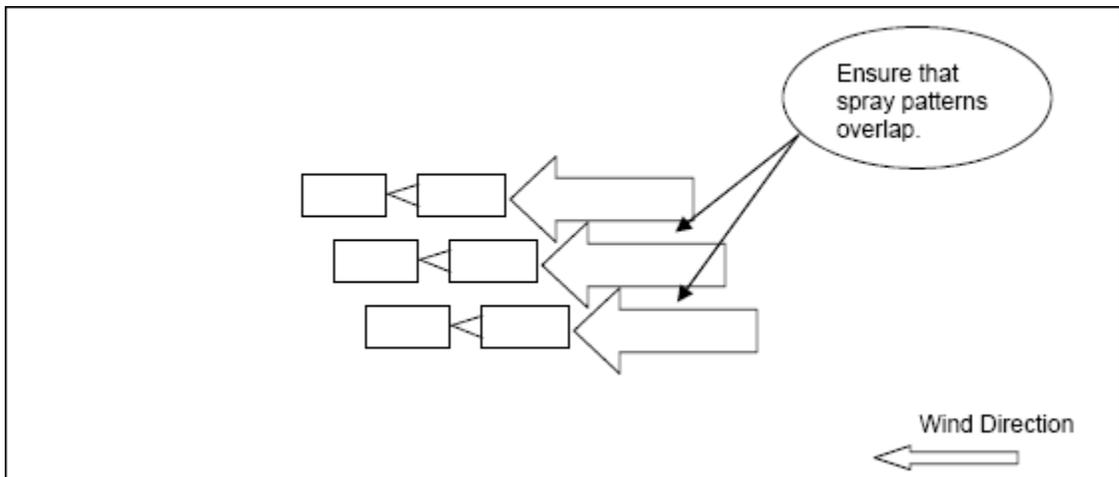


Figure H-8. FSDS Overlap Operation

(b) The CBRN decontamination unit must establish an overwatch position and control

decontamination operations. The decontamination control point (DCP) (Figure H-9) is the primary location to observe progress and control resupply operations. Since all contaminated situations are different, the leadership can determine if planned resupply operations will be sufficient to complete the mission.

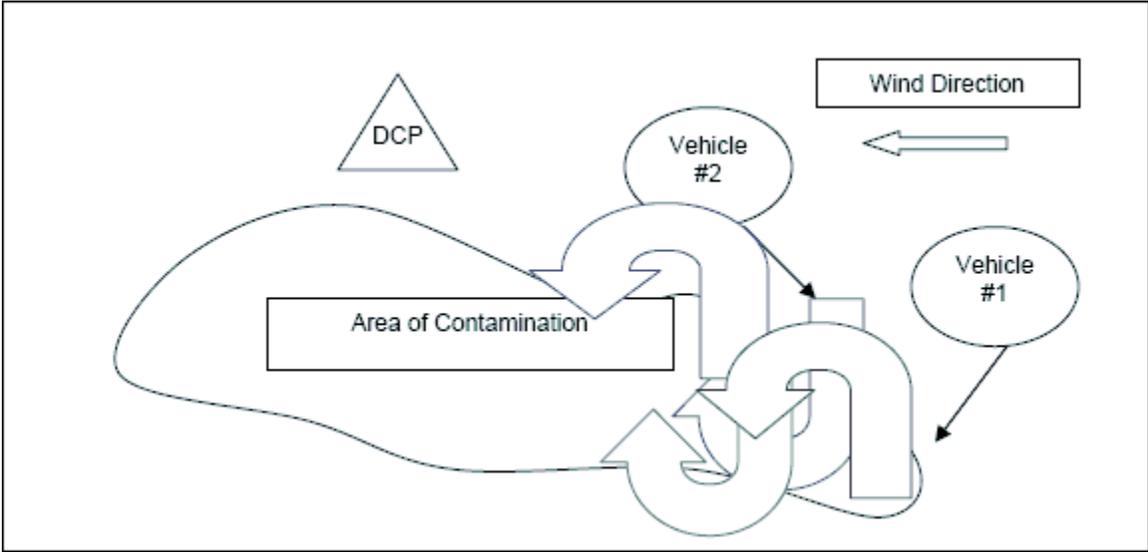


Figure H-9. Decontamination Control Point

(c) Obstacles or objects (such as vehicles, equipment, debris, or buildings) will be sprayed with the deck gun or spray hose as they are reached. If several systems are used, one can be identified as a deck gun/spray hose applicator while the other concentrates on horizontal surfaces.

(d) If multiple systems are used, they can work in relays; as one is spraying, the second can be conducting resupply. Application will progress through the contamination as vehicles resupply and continue where the last application finished. In this case, multiple vehicles will reduce the time it takes to complete decontamination. Resupply vehicles should remain upwind of the contaminated area. [Figure H-10](#) demonstrates how resupply vehicles will approach the hazard area and not cross into that area.

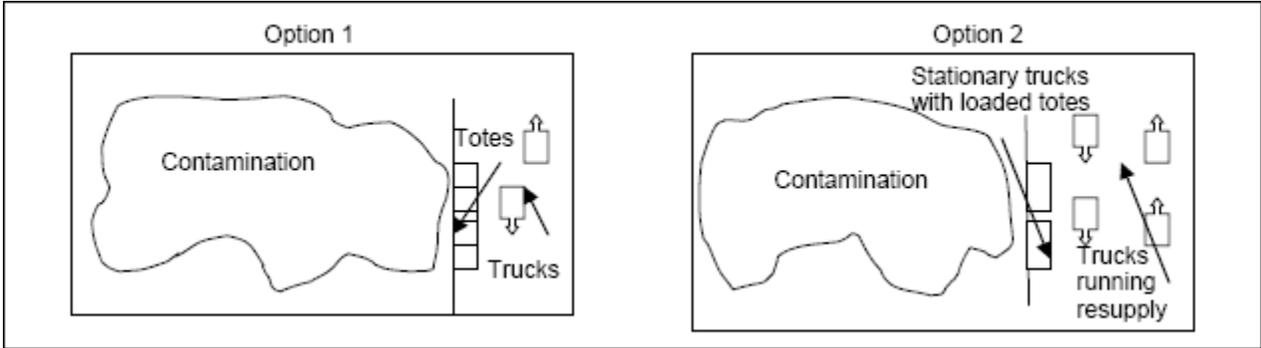


Figure H-10. Resupply COAs (Options 1 and 2)

e. Resupply COAs.

h. Safety and Coordination.

(1) When operating the spray cannon or spray wand, the operator must keep a supply of wipes available to continuously clear the mask eye lenses. The vehicle commander should also keep wipes available to assist the driver by cleaning the vehicle windows if necessary.

(2) When operating the spray wand, careful coordination must be made between the tank commander (TC), system controls operator, and the spray operator. When pressure is introduced to the hose, the operator must be aware that the pressure can be very powerful and could cause injury.

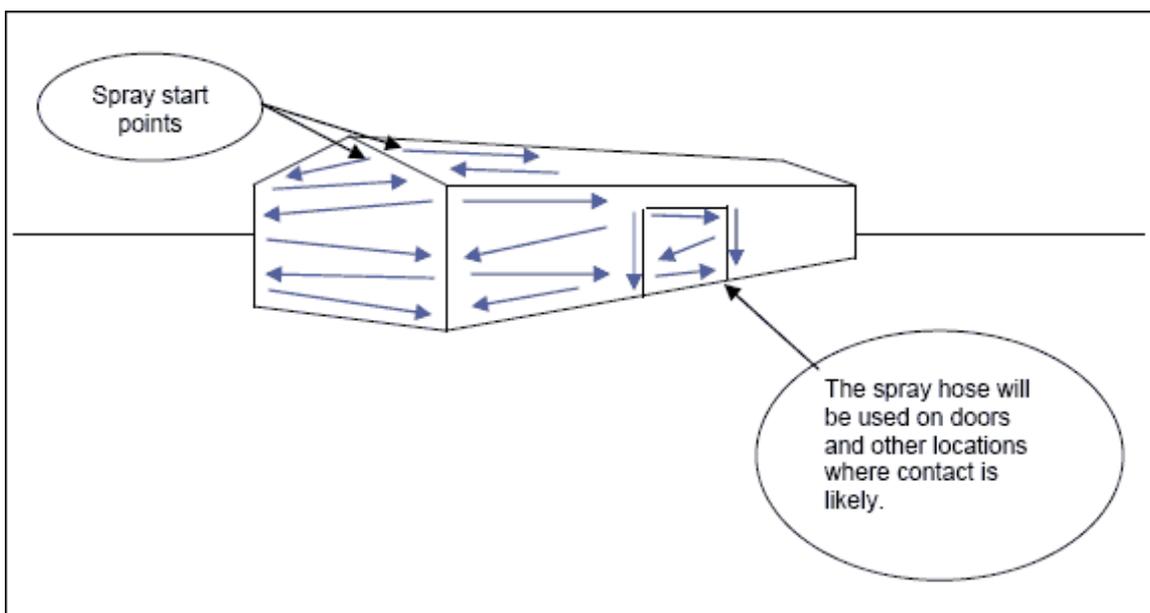


Figure H-12. Hose Reel Operation (Two-Person)

i. Postmission Actions.

(1) Interior decontamination of the vehicle should begin immediately upon completion of the mission. Interior seat covers and other interior covers must be removed and bagged as contaminated waste. If a crew member exits the vehicle, he should not reenter the interior until the mission is complete. This prevents the spread of contamination. If the crew member must reenter the vehicle, the SDS kit should be used to decontaminate gloves, boots, and contact areas.

(2) When all contaminated areas have been decontaminated, the FSDS will move toward the hot line at the upwind location of the contamination and commence standard equipment and troop decontamination operations. A thorough equipment decontamination and DTD site will be established, and all equipment and soldiers will process through the site.

NOTE: It has not been determined if a complete decontamination of the truck is possible.

(3) Security personnel must ensure that all access to the contaminated area is denied until sufficient contact time between the decontaminant and contaminant is achieved to guarantee the neutralization of the agent. Security personnel will remain upwind of the contamination and restrict entry until the area is determined to be

uncontaminated. Following a mission, the FSDS hoses should be purged and all tanks drained.

(4) The unit should prepare an NBC4 report and send it to higher HQ and adjacent units.