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WHITE PAPER

**Overview of Organizations and Processes Associated with CBR  
Air Treatment Technologies to Protect Building Indoor Air**

This memorandum briefly summarizes testing, verification, certification and procurement organizations and processes for Chemical/ Biological/Radiological (CBR) air treatment units used for building protection in the United States. It addresses private, civilian (Homeland Security) and military organizations, and includes a discussion of the current and expected efforts to provide “guidelines” to federal, state and local government for construction standards.

Overview

Several different public and private organizations have some role in various aspects of review, approval and selection of technologies involved in protecting buildings from CBR air threats. Most multi-agency federal government needs for CBR protection currently are defined through the Technical Support Working Group. They have identified very specific performance criteria, and technology will likely need to satisfy those requirements to be selected. TSWG also is the recipient of all unsolicited proposals made to the White House Office of Homeland Security. This situation will likely be affected significantly under pending legislation to establish the Homeland Security Department and a new technology evaluation and approval process.

HPI currently is working with the Office of the Secretary of Defense to improve access to DOD testing and evaluation facilities for these and other CBR technologies, helping technology owners to understand user needs and to understand and overcome other barriers to technology deployment. These activities should help prepare technology providers and users for the new technology evaluation processes to come.

I. Federal/Homeland Security

A. Technical Support Working Group (TSWG)

The Technical Support Working Group (TSWG) is an interagency organization of nearly 80 federal organizations, managed under the Department of Defense, that conducts the National Interagency Research and development program for Combating Terrorism through rapid research, development, and prototyping. TSWG’s role is to identify requirements, develop solutions, and fund and execute projects. Unsolicited proposals for chemical, biological and radiological (CBR) homeland defense technologies submitted to the White House Office of Homeland Security are forwarded to TSWG for handling,

through an arrangement with the White House Office of Science and Technology Policy, which works closely with TSWG on these matters.

TSWG carries out much of its work through Broad Agency Announcements (BAAs).<sup>1</sup> The BAA process constitutes a solicitation of concepts from those offerors capable of satisfying the Government's needs.

TSWG issues at least one BAA each year, and in the past year has issued a BAA that, in part, specifically addresses Adsorption Filter Technology for use in chemical/biological/radiological (CBR) environments, which provides useful insight into unmet user needs within the federal government:

R-885. Develop adsorption filters compatible with existing commercial building heating, ventilation and air-conditioning (HVAC) systems with enhanced capture efficiency, adsorption and/or chemisorption characteristics for chemical and biological threat agents. Adsorption and particulate filters must be standard 2' X 2' filters for minimum bypass slide-and seal housing. Filters should be no wider than 24", but smaller widths are preferred. Pressure drop across the clean adsorption and particulate filter ensemble should not exceed 3.0 inches of water (gauge) with no greater than 1.5 iwg final pressure loss across the individual adsorption or particulate filters separately at rated air flows of >1500 cubic feet/minute. Particulate filter efficiency of >99.97% for all particles between 0.3 and 10 microns is required. In addition to >99% adsorption of nerve, blister and blood agents from an ambient concentration of 1000 ppm with a breakthrough time of 15 minutes or greater, the filter should have a broad spectrum of adsorption for acid-forming and basic toxic industrial chemicals. Filter life goal is 5 years for both adsorption and particulate filters. A filter life indicator is desired. Pre-filters and humidity control are acceptable as a means to prolong the filter life of dry bed filters. Low cost desired: \$400 for 2'X2' adsorption filter, <\$100 for particulate filter. Regenerative (cleaning) capabilities are desired.

#### B. New Homeland Security Department (pending)

Legislation supported by the President and passing the House of Representatives on July 25, 2002 specifically addresses the issue of CBR technology development, testing, verification and deployment. A new position of Undersecretary for Science and Technology is given responsibility for countermeasures to chemical biological, radiological, nuclear (CBRN) and other emerging terrorist threats, including the development of a comprehensive research-based definable goals for such efforts and the development of annual measurable objectives and specific targets to accomplish and evaluate the goals for such efforts.

The Undersecretary will have responsibility not only for basic and applied research, but also for demonstration, testing, and evaluation activities that are relevant to any and all elements of the Department, through both intramural and extramural programs (except for health-based research and development). The Undersecretary must coordinate with other executive agencies in developing and carrying out the science and technology agenda to reduce duplication and identify unmet needs. This official will also establish

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<sup>1</sup> A BAA is a competitive research and development approach used for the acquisition of basic and applied research and development to fulfill requirements for scientific study, experimentation and demonstration to direct the advancement of state-of-the-art technology. The BAA provides for varying ideas, from a wide range of sources, including foreign contractors, that focus on a requirement or research interest.

Federal priorities for research, development, demonstration, testing and, as appropriate, procurement and transitional operation of technology and systems, including systems for detecting, preventing, and protecting against terrorist attacks that involve CBNR weapons and related materials.

Most significantly, the Undersecretary is charged with facilitating the deployment of technology that will serve to enhance homeland security, including the establishment of a centralized Federal repository for dissemination to Federal, State, and local government and private sector entities information relating to technologies, including systems for detecting, preventing, and protecting against terrorist attacks that involve CBNR weapons and related materials. The official will provide guidance, recommendations, and technical assistance as appropriate to assist Federal, state, and local government and private sector efforts to evaluate and implement the use of such technologies.

The Undersecretary will also maintain information for persons seeking guidance on how to pursue proposals to develop or deploy technologies that would contribute to homeland security.

Thus, the new Department will have the direct responsibility to address the issue of introducing new technology for CBR protection. The Homeland Defense Department designation of anti-terrorism technologies also qualifies those technologies for protection under a new system of risk management. The bill provides liability risk protection for companies who meet stringent requirements and who also obtain the maximum amount of liability insurance reasonably available. The new Department will establish a system to support what is intended to be exclusive Homeland Security Department review and approval of the safety and efficacy of technologies deployed in homeland defense. The pending legislation provides that for those products reviewed and approved by the Secretary, the Secretary will issue a certificate of conformance to the Seller and place the product on an Approved Product List for Homeland Security.

If enacted into law, this system of product approval is clearly going to be the major focus for all CBR technology providers.

## II. Standards, Guidance and Testing

### A. Civilian Standards and Guidance

Some federal agencies have issued their own security design standards, but no universal code or standard applies to all public and private sector buildings. Except for workplaces where exposure to toxic materials can be expected<sup>2</sup>, there are no minimum filtration standards or requirements that building owners must implement to protect against chemical, biological or radiological threats. However, there is a general duty for employers to provide a safe workplace, and under that legal requirement OSHA on

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<sup>2</sup> The Occupational Health and Safety Administration of the Department of Labor has promulgated a large number of specific standards for air quality in the workplace, but these requirements are complex and numerous, and are beyond the scope of this brief summary.

occasion has required employers to address exposure to possible leaks of hazardous air contaminants or even to design positive pressure rooms to protect operators from toxic chemicals. Nevertheless, that determination is made on a fact and circumstance-specific basis rather than as a general requirement for all buildings.

## 1. NIOSH/Interagency Workgroup on Building Air Protection

Following the September 11, 2001 terrorist attacks, the Office of Homeland Security (OHS)<sup>3</sup> formed the Interagency Workgroup on Building Air Protection under the Medical and Public Health Preparedness Policy Coordinating Committee of the OHS. The Workgroup includes representatives from many Federal agencies, including the National Institute for Occupational Safety and Health (NIOSH), which is responsible for conducting research and making science-based recommendations to prevent work-related illness, injury, disability and death). NIOSH led a group effort to assess building vulnerability to CBR threats and developed an interagency report guiding building owners on preventative steps they can take to reduce the likelihood and mitigation of the impact of such threats. <http://www.cdc.gov/niosh/bldvent/2002-139.html> This short-term guidance report is the first step of a more comprehensive approach the Workgroup is engaged in.

The report reaffirms that the decision concerning protective measures is a matter of individual owner determination. The report encourages building owners to conduct comprehensive building security assessments, but there is no specific formula that will determine a certain building owner's level of risk.

The guidance states that high efficiency filtration is one of the few measures that can be implemented in advance of an event to reduce the consequences of both an interior and exterior release of a particular CBR agent. However, the report recommends that the decision to increase efficiency "should be made cautiously, with a careful understanding of the protective limitations resulting from the upgrade." The building owner is urged to assess building filtration needs with a view to implementing the "highest filtration efficiency that is compatible with the installed HVAC system and its required operating parameters." However, the report notes that adsorbent filters (activated carbon) result in "substantial initial and recurring costs."<sup>4</sup>

## 2. Environmental Protection Agency Environmental Technology Verification (ETV) Program for Indoor Air Products

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<sup>3</sup> On October 8, 2001, President Bush established by executive order the Office of Homeland Security (OHS) which is mandated "to develop and coordinate the implementation of a comprehensive national strategy to secure the United States from terrorist threats or attacks."

<sup>4</sup> The report says that replacing filters is complicated by the higher pressure loss that typically accompanies higher efficiency filters, and higher pressure loss can result in "inadequate ventilation, reductions in heating and cooling capacity, or potentially frozen coils". It notes that filtration costs include the periodic cost of the filter media, the labor cost to remove and replace filters, and the fan energy cost required to overcome the pressure loss of the filters. It notes that HEPA filters and/or activated carbon absorbers "generally increase overall costs substantially."

The Environmental Protection Agency (EPA) Environmental Technology Verification (ETV) program verifies the environmental performance characteristics of commercial-ready technologies through evaluation of objective and quality assured data so that potential purchasers are provided with an independent and credible assessment of what they are buying. EPA, through a cooperative agreement with the nonprofit Research Triangle Institute (RTI), developed and manages an emissions testing and verification program specifically for certain products used indoors, including ventilation air filters. Under the ETV program technologies are verified under specific, predetermined criteria or protocols and adequate data quality assurance procedures. The program does not certify or guarantee a technology as meeting a standard or performance criteria into the future. Rather, its purpose is to provide credible data that the product or process performs as claimed by the developer or vendor.<sup>5</sup> The focus of this program includes assessment of high efficiency filters

### 3. GSA

GSA establishes design standards and criteria for new buildings, major and minor alterations, and work in historic structure for the Public Building Service. It also provides information on conducting building security assessments <http://hydra.gsa.gov/pbs/pc/facilitiesstandards/> (Facility Standards for the Public Buildings Service (PBS-P100)). However, there are no specific standards for CBR treatment or filtration.

### 4. American Society of Heating Refrigerating and Air-Conditioning Engineers (ASHRAE)

ASHRAE is an international membership professional association with 50,000 members whose objective is to advance through research, standards writing and continuing education the art and science of heating, ventilation, air conditioning and refrigeration to serve evolving needs of the public. ASHRAE has adopted a number of consensus standards related to air filtration systems, including:

- a. ASHRAE Standard 52.2-1999 entitled “Method of Testing General Ventilation Air Cleaning Devices for Removal by Particle Size” is a standardized laboratory test method for measuring the filtration efficiency of ventilation air filters used in residential and commercial buildings. The test uses the .3 – 10 micron size range, because it is the respirable particle size. Based on filtration efficiency and final pressure drop, the filter receives a Minimum Efficiency Reporting value.
- b. ASHRAE 52.1-19\_\_ addresses the methods of testing air-cleaning devices used in general ventilation for removing particulate matter. For CBR applications, ASHRAE Standard 52.1 is not relevant.
- c. ASHRAE \_\_\_\_ is being developed as a Standard Method of Test for Gaseous and Vaporous Contaminants.

- d. ASHRAE Standard 62.1-2001 entitled “Ventilation for Acceptable Indoor Air Quality” is considered the primary guidance for ventilation design and operations in the USA and Canada. This Standard provides general guidance on the applications of filtration and gaseous air cleaning under “Normal” occupancy conditions.
- e. Other guidance applicable to specific work environments (e.g., medical facilities) is available in the ASHRAE Handbook Series.
- f. ASHRAE also has provided Risk Management Guidance for Health and Safety under Extraordinary Incidents. <http://www.ashrae.org/> This report provides cautionary guidance on the use of filtration, indicating that filtration is a needed but not sufficient condition to minimize the impact of CBR incidents on occupants.

ASHRAE standards and documents are available for purchase and download at <http://www.confex2.com/store/ashrae/index.html>

#### 5. National Air Filtration Association

The National Air Filtration Association has developed a voluntary Product Certification Program for the purpose of certifying that air filter devices submitted under the program meet a set of published criteria and performance levels as stated by the Participant and submitted for certification on the NAFA’s Product Specification Form. The scope of this program is all media-style air filtration products used in general ventilation heating, ventilating and air conditioning (HVAC) systems.

#### 6. National Institute of Building Sciences (NIBS)

The NIBS provides a Whole Building Design Guide <http://www.wbdg.org> Again, the emphasis is on integrated system design taking into account a number of cost, performance, security and other factors.

#### 7. Military Standard for High Efficiency Filters.

One common method of rating high efficiency filters uses a procedure in Military Standard 282. This procedure measures how well small particles of a specific chemical are removed by the filter.

#### B. Military CBR Product Development and Testing

There are several organizations within the U.S. government whose mission involves developing and testing chemical and biological defense technologies. The same organizations that develop technologies also are able to test and evaluate commercial

technologies brought in from elsewhere, but the dual roles creates some difficulties for competing technologies.

1. DOD Chem/Bio Defense Program.

The DOD chemical and biological defense program is consolidated under the Deputy Assistant to the Secretary of Defense for Chemical and Biological Defense. Its principal purpose is to enable U.S. forces to survive, fight, and win in chemically and biologically contaminated environments. . Their role in homeland defense and consequence management is still evolving. Under this command, various elements carry out research and develop systems for CBR protection. DOD has identified its requirements in a Report to Congress. See <http://www.acq.osd.mil/cp/ss.html> The collective containment requirements most relevant to advanced filtration are described in Attachment I.

a. SBCCOM. The U.S. Army Soldier and Biological Chemical Command is the military's locus of expertise on biological and chemical weapons. SBCCOM provides support in three main areas of defense: research, development and acquisition; emergency preparedness and response; and safe, secure chemical weapons storage, remediation and demilitarization. SBCCOM provides defense capabilities by fostering partnerships to develop and implementing soldier, chemical, and biological defense systems to ensure maximum protection for the United States. For a list of projects/products, see <http://www.sbccom.army.mil/products/nbc.htm><sup>6</sup>

8. DOD Defense Threat Reduction Agency (DTRA).

Under DTRA, Department of Defense resources, expertise and capabilities are combined to meet the goal of ensuring the United States is ready and able to address present and future WMD threats. DTRA accelerates state-of-the-art technologies to improve force application/protection modeling capabilities, provide enhanced and sensors, defeat WMD facilities, and optimize capabilities for use by Special Operations Forces. The agency evaluates the lethality of conventional, biological, chemical, and other advanced weapons against a broad spectrum of target types in warfighting and terrorist scenarios. This expertise provides commanders with options for effective targeting against underground or hardened structures, as well as advanced capabilities to assess battle damage.

9. DOD Defense Advanced Research Programs Agency

The Defense Advanced Research Programs Agency (DARPA) operates within the Department of Defense a Biological Warfare Defense Program. DARPA's program

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<sup>6</sup> This command leads the federal Domestic Preparedness Program designed to enhance the capability of federal, state and local emergency response to incidents involving nuclear, biological and chemical terrorism. This new interagency effort provides train-the-trainer instructions and emergency response exercises for 120 cities across the United States, chemical and biological expert assistance and leadership for the Department of Defense Chemical and Biological Rapid Response Team.

funds R&D projects supporting revolutionary approaches to biological warfare defense, emphasizing high-risk, high-potential technologies. DARPA's programs support the development of technologies principally for military warfighting applications.

5. Department of Energy Chemical and Biological Nonproliferation Program (CBNP)..

DOE's Chemical and Biological Nonproliferation Program (CBNP) program funds R&D to develop advanced technologies to enable the United States to more effectively prepare and respond to the use of CB weapons. Like TSWG, DOE's program supports the development of technologies for civilian end users, which include federal, state, and local emergency response personnel.

6. Nuclear Regulatory Commission and the Department of Energy.

The NRC and the Department of Energy have promulgated standards pertaining to air and gas cleaning activities for nuclear facilities. For example, safety-related air-cleaning units used in the engineered safety features (ESF) ventilation systems of nuclear power plants reduce the potential onsite and offsite consequences of a radiological accident by adsorbing radioiodine. To ensure that the charcoal filters used in these systems will perform in a manner that is consistent with the licensing basis of a facility, most licensees have NRC requirements in their facility technical specifications (TS) to periodically test (in a laboratory) samples of charcoal taken from the air-cleaning units. NRC requires testing of car charcoal samples in accordance with ASTM D3803-1989

7. DOD Laboratory and Test Ranges.

Currently, the facilities for testing and evaluation of CBRN technologies are mostly carried out in Department of Defense or Department of Energy Facilities, including those laboratories in the U.S. Army Soldiers and Biological Chemical Command, and some of the 21 Major Range Test Facility Bases (MRTFBs), including at Dugway (chem/bio), and Aberdeen Proving Ground (chem/bio) <http://www.acq.osd.mil/te/mrtfb.html> HPI is helping DOD develop a single point of access to all the DOD ranges to facilitate industry-funded testing.

## CONCLUSION

The definition of need for CBRN air treatment systems and the system of standards, guidance, and processes for testing, evaluation and demonstration involves many different organizations. The new Homeland Security Department will likely centralize decisionmaking and lessen liability barriers, but those organizations and processes have yet to be established. Organizations who are the first to journey through the new process will likely have a significant competitive advantage, but they also face the highest risks and costs in navigating through it.

Attachment 1  
DOD Requirements for Collective Protection Technologies

In its 2002 Report to Congress, DOD Identified its CBRN R&D activities for collective protection technologies as follows: “**Collective protection equipment** consists of various types of CBR protective filters, entry/exit, and air movement devices that provide filtered air to a wide range of applications, transportable shelter systems equipped with CBR filtration systems and, in selected cases, environmental control. Collective protection in the form of overpressure can be applied to mobile and fixed command posts, medical facilities, rest and relief shelters, buildings/fixed sites, vehicles, aircraft, and ships. Lightweight shelters integrated with CBR filtration, environmental control and power generation facilities for medical treatment facilities have been developed and are in production. Technology improvements are being pursued to reduce power requirements and improve filtration capacity against current and future CBR agents. Technologies that reduce weight, volume, cost, and improve the deployability of shelters and filtration systems are also being pursued.”

The Protection Modernization Strategy identified the following strategies for Collective Protection (where air filtration would be most useful):

**Near term: FY 02-03**

- Chemically Protected Deployable Medical Systems (CP DEPMEDS)
- Chemically Hardened Air Transportable Hospital (CHATH)
- Rapid insertion of technology improvements into existing equipment (JCPE)
- Marine Corps -Protection for all combat vehicles and unit shelters
- Army -NBC protection for tactical Medical units (CB Protective Shelter, CBPS).
  - Apply regenerable vapor filter to Comanche,
  - Apply collective protection to advanced vehicle concepts.
- Air Force - Upgrade/install collective protection into existing rest/relief shelters.
- Navy - Backfit ships with contamination free protected zones - (Collective Protection System Backfit)

**Mid Term: FY04-09**

- Improved filters to extend filter life, reduce maintenance and reduce logistical burden
- Reduced logistics burden, improved protection against current and future threats
- Improved current collective protection filters and equipment (JCPE)
- Support medical treatment in a CB environment for Airborne, Air Assault, and Heavy Divisions (CBPS)
- Lighter, more mobile, easier setup, more affordable shelters (JTCOPS)

**Long Term FY 10-19**

- Family of advanced collective protective systems for vehicles, shelters, ships, and light forces
- Regenerable/advanced protective filtration for vehicles/vans/shelters