North Korea is playing dangerous games !

CBRNE Newsletter Terrorism

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Chem News

www.cbrne-terrorism-newsletter.com

Future military uniforms could automatically transform into hazmat suits

Source: http://www.gizmag.com/breathable-gas-blocking-uniforms/25320/

While there *are* already protective cover-all suits that offer protection against chemical and biological agents, it's unrealistic to suggest that soldiers should carry such suits with them at all times, and hurriedly pull them on in the event of an attack. Instead, research teams from several institutions are developing something a little more practical – uniform fabric that automatically becomes impermeable to toxic substances, when it detects them in the area.

Under normal conditions, the material would be very breathable, allowing its wearer to stay cool. If something like poisonous gas were present, however, the pores of the fabric would respond by closing up – some degree of breathability would be maintained, although the pores would now be too small to allow the toxic molecules to pass through. Presumably, the uniforms would include some sort of hood/mask.

To make this possible, the teams are developing highly-breathable membranes, with pores composed of vertically-aligned carbon nanotubes. Those nanotube pores will allow for optimal gas exchange back and forth through the fabric, as long as no threat is present. The pores will also have a surface layer, however, that causes them to contract when exposed to chemical or biological agents.

Another option, which the researchers are also looking into, involves the fabric first trapping toxic molecules in its outer layer, and then shedding that layer like exfoliated skin.

The collaborative Dynamic Multifunctional Material for a Second Skin Program includes scientists from the University of Massachusetts Amherst, Lawrence Livermore National Laboratory, the U.S. Army Natick Soldier Research Development and Engineering Center, MIT, Rutgers University, and Chasm Technologies, Inc.

They hope to have uniforms made from the material deployed in the field in less than ten years

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Indian scientists devise 16 disaster management drugs

Source: http://www.thehindu.com/health/medicine-and-research/indian-scientists-devise-16-disaster-management-drugs/article4304534.ece?goback=.gde_3711808_member_204064367

Preparing to deal with any future chemical, biological, radiological and nuclear (CBRN) incidents, Indian scientists have devised 16 drugs that can be used for disaster management. These include an anti-cyanide drug, an anti-nerve gas drug and an anti-toxic gas drug.

Several radioactive decorporation agents and drugs for anti-cyanide, anti-nerve gas and toxic gas injuries have been approved by the Drug Controller General of India as trial drugs.

Developed by scientists at the Defence Research and Development Organisation (DRDO) Institute of Nuclear Medicine and Allied Sciences (INMAS) here, the drugs have passed the efficacy test and will be cheaper than those currently available in the market.

"Sixteen new drugs have been approved by the Drug Controller General of India (DGCI) as trial drugs for disaster management. These include an anti-cyanide drug, an anti-nerve gas drug,

an anti-toxic gas drug and several radioactive decorporation agents," Aseem Bhatnagar, in charge of the project at INMAS, told *IANS*.

These will be used as samples for the users, including the armed forces, the paramilitary, the National Disaster Management Authority (NDMA), the Department of Atomic Energy (DAE) and the Ministry of Health.

"Batch production of these drugs is being undertaken in collaboration with the pharmaceuticals industry through contract manufacturing. About 50,000-200,000 doses (licensed for human use) are expected to be manufactured by March 2013," Bhatnagar said.

The DGCI approvals cover all-India use for 15 years for any number of victims.

Since there cannot be proper phase two trials of drugs useful in disasters, their use in any future incident has been approved as trial drugs due to a legality.

"These shall also be used for continuing clinical trials and for stockpiling. This is necessary to effectively plan stockpiling cost and perpetually (it is envisaged to provide the drug at cost price to the users). The average cost price is expected to be less than 15 percent of market price in all cases," Bhatnagar said.

Several of these drugs have been patented by the defence ministry.

"The contract has been given to pharmaceutical companies to ensure that quality checks and pricing remains the prerogative of the defence ministry. Besides, adequate stocks can be retained in a cost-effective way and companies can initiate mass production in case of a disaster without any time wastage," Bhatnagar said.

INMAS previously made and supplied drugs against nuclear, biological and chemical (NBC) incidents during the 2010 Commonwealth Games and to meet an emergency requirement of the Indian Navy.

"We also plan to keep some with the Delhi Metro Rail Corporation (DMRC) for usage during any disaster," Bhatnagar said.

Scientists say that research and development and coordination will enhance the shelf life of NBC drugs by 60-100 percent and this project is planned in coordination with other government agencies.

"A mission mode project is planned to establish nuclear security in the national capital region by way of drugs, equipment and training to six echelons of medical services around Delhi under a project for seven years," Bhatnagar added.

INMAS had developed a skin radioactivity decontamination kit (shudhika) that was given for production to a company in Pune.

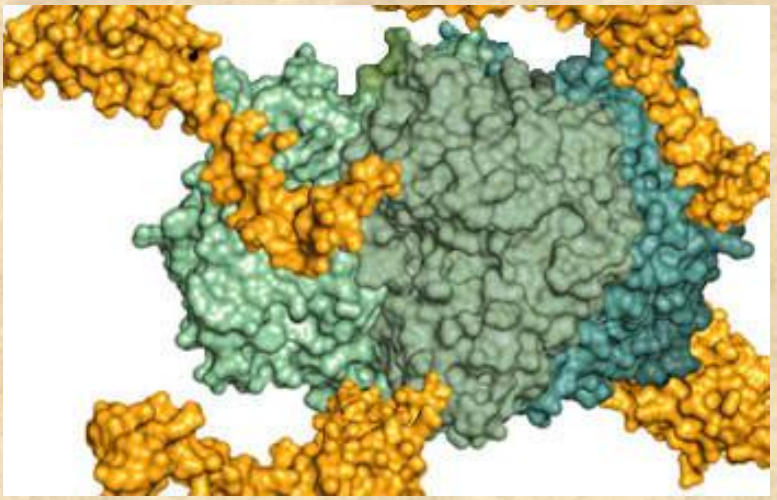
"Its market cost is more than Rs.12,000 and we are developing it for just Rs. 1,000 (less than $2). Five

hundred such kits will be made available to users, including the services, as samples by March," Bhatnagar said.

Neutralizing the effects of lethal chemical agents

Source: http://www.homelandsecuritynewswire.com/dr20130113-neutralizing-the-effects-of-lethal-chemical-agents

Organophosphorus agents (OPs) are used both in farm pesticides, and by terrorists and rogue states. About 200,000 people die each year across the world from organophosphorus agents (OP) poisoning, through occupational exposure, unintentional use, and misuse, mostly in developing countries like India, Pakistan, and Sri Lanka and through deliberate terrorist activities. OPs include compounds like Tabun, which was developed in 1936 by German scientists during the Second World War, Sarin, Soman, Cyclosarin, VX, and VR.



Researchers develop an enzyme treatment which could neutralize the effects of OPs.

An enzyme treatment which could neutralize the effects of lethal chemicals responsible for the deaths of hundreds of thousands of people across the world has been developed by experts at the University of Sheffield.

Organophosphorus agents (OP) are used as pesticides in developing countries and acute poisoning is common because of insufficient control, poor storage, ready availability, and inadequate education amongst farmers.

A University of Sheffield release reports that it is estimated about 200,000 people die each year across the world from OP poisoning, through occupational exposure, unintentional use, and misuse, mostly in developing countries like India, Pakistan, and Sri Lanka and through deliberate terrorist activities.

OPs include compounds like Tabun, which was developed in 1936 by German scientists during the Second World War, Sarin, Soman, Cyclosarin, VX, and VR.

Model of polysialylation in vitro

Using a modified human enzyme, scientist Professor Mike Blackburn from the University of Sheffield's Department of Molecular Biology and Biotechnology collaborated in a consultancy role with Professor Alexander Gabibov of the Shemyakin-Ovchinnikov Institute, Moscow, and Professor Patrick Masson of the Département de Toxicologie, Centre de Recherches du Service de Santé des Armées, to create a "bioscavenger" which was found to protect mice against the nerve agent VR and showed no lasting effects.

In studies performed at the Institute of Bioorganic Chemistry in Pushchino, Russia, a total of eight mice were treated with the new enzyme after being subjected to enough of the VR agent to kill several of the animals — about 63 mg — and all survived.

Professor Blackburn said: "This current publication describes a novel method to generate a bioscavenger for the Russian VR organophosphorus agent with the key property of being long-acting in the bloodstream.

"That has been achieved by a combination of chemical surface modification (polysialylation) and biotechnology of production (through the use of an in vitro CHO-based expression system employing genes encoding butyrylcholinesterase and a proline-rich peptide under special promoter control)."

— Read more in Denis G. Ilyus et al., "Chemical polysialylation of human recombinant butyrylcholinesterase delivers a long-acting bioscavenger for nerve agents in vivo," Proceedings of the National Academy of Sciences *(7 January 2013)*

Abstract

The creation of effective bioscavengers as a pretreatment for exposure to nerve agents is a challenging medical objective. We report a recombinant method using chemical polysialylation to generate bioscavengers stable in the bloodstream. Development of a CHO-based expression system using genes encoding human butyrylcholinesterase and a proline-rich peptide under elongation factor promoter control resulted in self-assembling, active enzyme multimers. Polysialylation gives bioscavengers with enhanced pharmacokinetics which protect mice against 4.2 LD_{50} of *S*-(2-(diethylamino)ethyl) *O*-isobutyl methanephosphonothioate without perturbation of long-term behavior.

FiberTect® Technology for Dry Decontamination

Source: http://news.cbrnresourcenetwork.com/newsDetail.cfm?id=66

FiberTect® is a three layer, inert, flexible, drapable, nonwoven composite substrate for absorbing and adsorbing chemical warfare agents (CWAs), toxic industrial chemicals (TICs), toxic industrial materials (TIMs), and pesticides.

FiberTect® is a three layer, inert, flexible, drapable, nonwoven composite substrate for absorbing and adsorbing chemical warfare agents (CWAs), toxic industrial chemicals (TICs), toxic industrial materials (TIMs), and pesticides.

Made by First Line Technology (Chantilly, VA), it can be packaged into personal or responder decontamination kits and used in conjunction with Reactive Skin Decontamination Lotion (RSDL®) to provide more effective decontamination.

FiberTect is the next generation of activated carbon dry decon. It is effective in decontaminating personnel, weapons, and sensitive parts of equipment. FiberTect can also be used to wipe away bulk chemicals. Users include first responders and receivers, hospitals, HazMat units, military personnel, and firefighters. This patented technology (US 7,516,525) is devoid of loose particles, self-contained and packaged for easy use, storage, and transport.

FiberTect Layers, Materials, and Treatments

FiberTect features a three layer design with top and bottom fabric layers and a center layer of fibrous activated carbon that is needle punched into a composite fabric. The top and bottom layers provide structural coherence, improving mechanical strength and abrasion resistance, while the center layer acts as the active decontaminant.

The materials used to manufacture the outer layers of FiberTect may vary in order to best provide absorption and/or adsorption properties for multiple functional uses. Outer layer materials that could be used to tailor FiberTect to specific applications include Kevlar, Nomex, rayon, wool, nylon, cotton, viscose, polypropylene, modified acrylic, and standard polyester.

Once fabricated, FiberTect may be coated with additional treatments to further enhance its effectiveness. Possible treatments include: anti-bacterial, anti-fungal, anti-microbial, anti-mildew, flame retardant, hydrophilic, hydrophobic, and silicon.

FiberTect Form Factors

FiberTect is available in several different form factors.

FiberTect Mitts allow for easy clean-up of bulk chemicals on people, weapons, and sensitive equipment and can be used over gloves.

FiberTect Wipes are versatile pieces of cut cloth that come individually wrapped and can be used in a variety of dry decon situations.

Perforated rolls of FiberTect Wipes are ideal for instances in which the amount of dry decon needed is not known.

FiberTect Development and Testing

FiberTect development and testing was sponsored by the U.S. Department of Homeland Security and managed by the Technical Support Working Group, Office of the Assistant Secretary of Defense for Special Operations/Low Intensity Conflict, U.S. Department of

Defense. Product testing was conducted by Lawrence Livermore National Laboratories (LLNL).
FiberTect proved superior in all testing results against 30 comparable products for decontaminating against toxic chemical agents, TICs, and TIMs. Challenge chemicals and results include:

- Sulfur Mustard: **Outperformed** all 30 other sorbents for absorptive capacities directly from skin (95% removal) and adsorptive capacities, including current military M291 sorbents.
- Methylparathion (organophosphate): **Outperformed** all sorbents for absorptive and adsorptive capacities.
- 70% Nitric Acid, 70% Sulfuric Acid, 10 % Sodium Hypochlorite, and P-Zylene: **No material degradation**.
- Water and P-Xylene: **Outperformed** other sorbents for both hydrophilic and hydrophobic absorptive capabilities.

EU, US dumping toxic waste in Africa

Source: http://www.theeastafrican.co.ke/news/EU-US-dumping-toxic-waste-in-Africa/-/2558/951790/-/view/printVersion/-/1daextz/-/index.html

European states are still using African coasts as a dumping ground of toxic waste, even after enactment of legislation aimed at ending the practice by the European Union.
The worst examples of such dumping in the recent past, according to a report by the international environmental campaign group Greenpeace, is at the Somali port of Eel Ma'aan, north of Mogadishu.

Greenpeace is now calling on the United Nations to investigate the dumping of toxic and radioactive materials in Somalia.
In a 36-page document titled "*Toxic Ships*," the UK-based group claims that it has photographic evidence from an inconclusive investigation by the Italian authorities into the suspected burying of shipping containers filled with toxic waste inside the foundations of the port at Eel Ma'aan, in the 1990s.
The EU adopted tough regulations on e-waste in 2003 but almost 70 per cent is still unaccounted for, Greenpeace said, citing figures from the European Commission.
"Waste management is extremely lucrative," the group said, citing a sector turnover of €100 billion ($124 billion), providing up to 1.5 million jobs.
Europe generates some 1.3 billion tonnes of household and industrial waste a year, plus 700 million tonnes of agricultural waste, according to the European Environment Agency.
Of this, 40 million tonnes is hazardous."
Ever since ocean dumping of industrial and radioactive waste was banned by the London Convention in 1993, Greenpeace says that "rumours of dumping operations in the Mediterranean, Southeast Asia, and off the coast of Somalia had been circulating, but governments have done little or nothing to verify them at source."
But it says despite the new legislation, "the dirty, lucrative business goes on" and that "every day "toxic ships" sail from EU ports with cargos of toxic waste destined for a developing country.
Between 1988 and 1994, Greenpeace revealed 94 attempted or actual cases of hazardous waste exports to Africa, involving over 10 million tonnes of residues.
Some schemes included the building of local waste management facilities, incinerators and landfills.

Others concerned radioactive waste — such as the infamous ODM project that targeted at least 16 different African countries.

Many schemes, however, were simple dumping operations.

Waste containers were shipped following the path of least resistance and weakest governance, ending up in remote areas of countries such as Equatorial Guinea, Lebanon, Somalia and the Congo.

Toxic waste was also dumped on Nigerian and Haitian beaches.

European countries have been facing the challenge of dealing with the hazardous waste they produce for at least 30 years.

Greenpeace says that "as the cost of managing and disposing of this waste safely became clear, governments began exporting the problem to developing countries where environmental and workplace legislation is either inadequate or unenforced."

Evidence of growing environmental crime in waste management forced European Union countries to adopt legislation to curb waste shipments to poor countries.

Unfortunately, proper enforcement of such provisions has been lacking, Greenpeace says.

In July 2009, the United Nations Office on Drug and Crime (UNODC) published the report, "*Transnational trafficking in West Africa*," in which it identifies trafficking in persons, drugs, oil, cigarettes, counterfeit medicines, toxic waste and electronic waste as posing a serious threat to security and development.

Greenpeace says that it is "not possible to document at EU level what specific kind of hazardous and problematic waste is shipped across boundaries, because 40-50 per cent of waste shipped outside the EU is defined simply as 'other waste.' However, the nature of such waste is largely unknown."

But Greenpeace concludes by saying, "It is likely that most waste shipments result in environmental and public health crimes in receiving countries."

Greenpeace says that the UN must carry out an independent assessment on the alleged dumping of toxic and radioactive waste in Somalia, particularly in the area of the port of Eel Ma'aan.

It also calls upon the EU to implement its own toxic waste prevention measures, which are one of the pillars of the EU waste policy.

It particularly singles out the Italian government, which it says "must create a strong co-ordination among all the investigative authorities (*Procura della Repubblica*) which have been, and still are, working on the issue of toxic and radioactive waste trade, to identify and neutralise the network of people and enterprises managing the illegal waste trade shipped to developing countries (and possibly dumped into the sea) with the help of criminal networks and the support of state civil servants."

"Banning shipments of hazardous waste for disposal to the poorest countries is a laudable achievement," Greenpeace said, referring to EU adoption of the 1989 Basel Convention, which was ratified by most EU states by 1998.

"Yet large amounts of waste are shipped from Europe and the US to Africa and Asia on a daily basis," it said, noting that most are illegal shipments of electronic or e-waste, such as computers, cell phones and television sets.

The UN Office on Drugs and Crime has estimated that the EU generates 8.7 million tonnes of e-waste a year and that African countries, primarily Nigeria and Ghana, "run the risk of becoming the rubbish dumps of the planet."

"Lack of enforcement, control and data collection on EU waste exports is common in all member states for the very simple reason that illegal waste shipments to poor countries save a lot of money for both business and governmental agencies in charge of monitoring the implementation of EU waste legislation," Greenpeace said.

It urged the EU to implement its own toxic waste prevention measures.

A chapter of the 37-page report is devoted to Somalia and the release to Greenpeace of an Italian investigation into the suspected dumping of radioactive and other toxic waste at Eel Ma'an from 1990 to 1997 in an alleged deal between Italian businesses and local warlords.

Investigations

The inquiry was eventually dropped for lack of evidence because the authorities were unable to inspect the site.

The UK-based *Financial Times* newspaper said that in 2005, Giancarlo Marocchino, a businessman at the centre of the investigation, testified before a parliamentary inquiry into the deaths of two Italian journalists in Mogadishu and denied involvement in dumping

THREATWATCH

2013 And The Drama Continues…

Sure, sure, the Armageddon of December 2012 passed us by; once again the doomsayers were wrong! Remember the planetary alignment of 1977, when all the planets were aligned in a plane and the gravity was going to crush the earth? Remember the millennium crisis? The disasters invoked by the comet Hale Bop? And yet... Still plenty to write about.

Welcomed to our 4th year of THREATWATCH. This issue will broaden the scope of news and information slightly beyond just CBRNE issues, into special operations in general, including tactical and public order topics. The seemingly endless well of chemical, biological, and nuclear disaster articles, while gloomy, is not really very interesting.

This promises to be a busy year, as the security situation deteriorates in places like Mali, Syria, Iran, Algeria, and Yemen. Plenty to see here!

Active shooter incidents are occurring more frequently, or at least getting more press. A simple internet search over the last 50 years will reveal hundreds of events similar to Newtown.

Planning for disaster seems more important than ever in light of world events, and you can find loads of information about personal preparation. Consider it the cheapest insurance available by preparing yourself.

Worldwide, food and water resources are becoming more precious, as global weather issues are making deserts out of arable land and causing skyrocketing food and fuel prices. We have already seen the results of this, in Syria and Egypt.

Explosives devices remain a credible threat in any society or country. Increasing economic turmoil causes poverty, and poverty breeds terrorist activity. Active shooter incidents, with the proliferation of crazies and easy access to firearms, makes them a very high risk domestic threat.

Once again, I must go to the readership, cap in hand, and ask, no, BEG, for articles of interest. I am happy to do the research and writing, but feed me. I've read thousands of pages of stuff so boring that would petrify birds in flight, in order to create a few thousand words that hopefully keep the readership awake.

I need writers, or articles, or ideas. I will publish and credit any submissions, or you can remain anonymous and I will steal your ideas for my own if you prefer. Drop me a line. And, as always, keep yourself informed, eyes open, and stay safe.

THREATWATCH
Bimonthly CBRNE Newsletter
Marc Dugas, Paramedic, CBRNE Technician
Contact: Threatwatchtoronto@gmail.com

Des millions de conteneurs maritimes hautement toxiques

Source:http://www.lemonde.fr/planete/article/2013/01/02/du-poison-dans-les-conteneurs-maritimes_1812005_3244.html

C'est un danger identifié par les services de l'Etat, mais que les consommateurs ignorent. De 15 % à 20 % des conteneurs, soit un sur cinq, qui arrivent dans les ports européens, contiennent des gaz extrêmement dangereux, cancérigènes ou neurotoxiques. Le phénomène est massif : un million de conteneurs chargés de marchandises arrivent en Europe chaque semaine par bateau. Ces substances toxiques, inodores et incolores menacent toute une chaîne de travailleurs : dockers, douaniers, logisticiens, chauffeurs, manutentionnaires... jusqu'au consommateur lui-même.

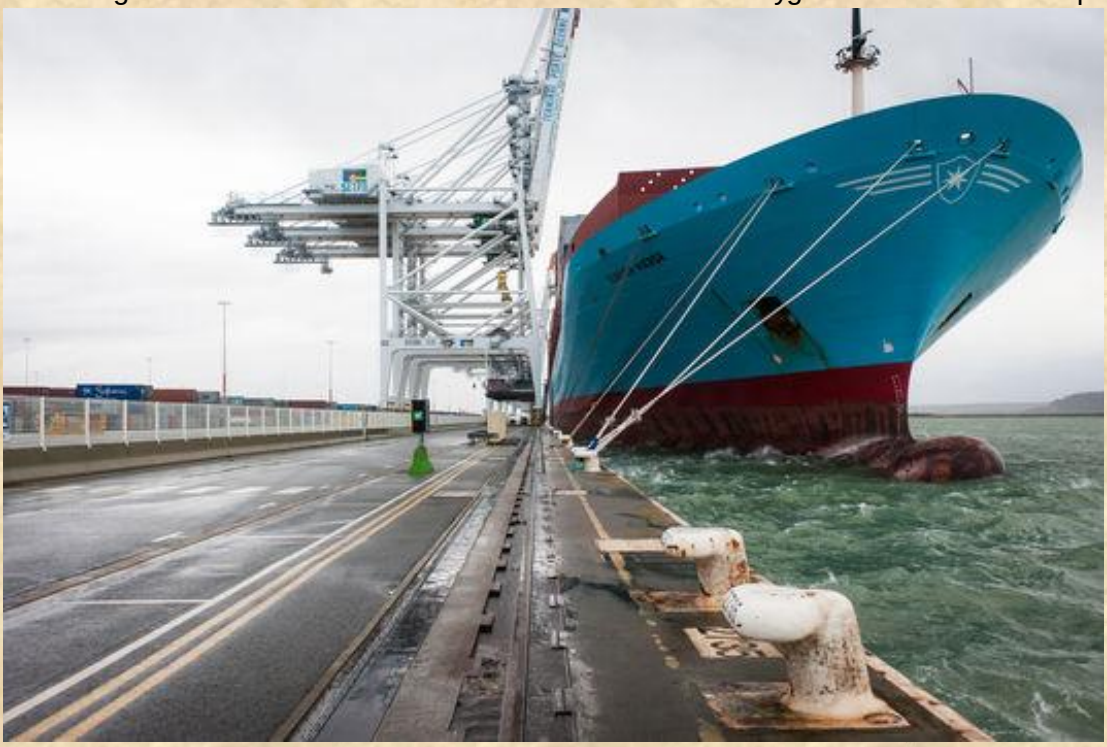
En 2010, aux Pays-Bas, en déchargeant un conteneur de verre transporté dans des caisses en bois en provenance de Chine, deux manutentionnaires ont été grièvement intoxiqués. L'un est resté cinq jours dans le coma, l'autre a vu sa santé gravement altérée : perte importante de poids, perte de l'odorat et du goût.

La présence de ces gaz est due en partie aux opérations de fumigation, une pratique nécessaire, parfois obligatoire, destinée à éliminer les moisissures et les animaux nuisibles durant le transport et à éviter l'introduction dans les pays importateurs de parasites, de bactéries et de maladies. C'est sans doute par la voie d'un conteneur de poteries chinoises que le frelon asiatique a envahi l'Europe.

SOLVANTS, GAZ TOXIQUES...

Pour éviter tout danger, cette opération de fumigation est en principe entourée de précautions. Les conteneurs doivent être aspergés de gaz puis immédiatement ventilés avant d'y faire pénétrer la marchandise. Ils doivent faire l'objet d'une signalisation spécifique apposée sur la porte : une étiquette "danger, cet engin est sous fumigation", illustrée d'une tête de mort et du numéro ONU 3359. En mars 2010, l'Union européenne a interdit l'utilisation du bromométhane, considéré comme trop nocif. Mais de nombreux pays continuent d'utiliser ce gaz. Surtout, très peu d'entreprises se conforment à l'obligation de mentionner sur les conteneurs la présence de gaz toxiques, pour ne pas se soumettre à l'obligation de défumiger.

Une autre source toxique, plus insidieuse, menace également la santé des travailleurs



des ports et des consommateurs : les gaz et vapeurs dégagés par les marchandises elles-mêmes durant le transport. Les meubles, les chaussures, les vêtements, fabriqués en Asie, notamment au Vietnam et en Chine, contiennent fréquemment des solvants à base de toluène et de benzène qui sont cancérigènes. Et, dans ce cas, aucune mention sur les conteneurs ne permet aux personnels des ports de se prémunir contre les émanations toxiques. Seules des analyses de l'atmosphère des conteneurs peut permettre de détecter le danger. Elles sont rarement pratiquées.

Les gaz utilisés pour la fumigation peuvent-ils contaminer les marchandises ? Dès 2005, une étude de l'Institut national des Pays-Bas pour la santé publique et l'environnement avait révélé que des médicaments, des aliments ou des matelas contenaient du bromure de méthyle.

DANGEROSITÉ DE LA FUMIGATION

Trois ans plus tard, devant le 18e congrès de la société européenne de pneumologie, à Berlin, une équipe de chercheurs allemands de l'Institut central de médecine professionnelle et maritime de l'université de Hambourg mettait au jour l'ampleur du danger. Après avoir analysé l'atmosphère de deux cents conteneurs débarqués du port de Hambourg (Allemagne) et autant à Rotterdam (Pays-Bas), Xavier Baur et Lygia Budnik avaient conclu que 97 % d'entre eux présentaient des résidus de gaz, principalement du 1,2-dichloroéthane et du bromure de méthyle, parfois conjugués à la présence de benzène et de toluène. 19 % présentaient des taux de gaz supérieurs aux limites autorisées. Les deux chercheurs confirment la contamination des produits transportés.

Alertés par les syndicats, l'administration française des douanes et la direction de la gendarmerie sont parfaitement au fait de la dangerosité de la fumigation. En juin 2011, la direction générale des douanes a fait parvenir une note détaillée à ses services pour *"prévenir le risque d'exposition aux gaz toxiques présents dans les conteneurs"*. Dans ce document de quatre pages, l'administration explique qu'elle a procédé en 2010 à des tests au port du Havre, où sont traités chaque année 2,3 millions de conteneurs. *"Ce test, qui s'est déroulé sur une période de trois semaines, a révélé une concentration de gaz de fumigation supérieure aux normes européennes dans 14 % des conteneurs."*

Les syndicats évoquent un chiffre plus alarmant : 28 % des conteneurs, selon Sébastien Géhan, le secrétaire général du syndicat des douanes CGT, ont révélé des taux de gaz toxiques

supérieurs au seuil de sécurité. Aucun conteneur ne portait la signalisation de leur fumigation.
A la suite de ces constats, la direction des douanes a préconisé plusieurs mesures. Elle demande aux agents de *"se placer systématiquement sur le côté du conteneur lors de l'ouverture"* puis de *"respecter un délai d'aération de 30 minutes avant intervention"* et *"d'utiliser masque, gants, lunettes, casque de protection approprié pour la vérification des marchandises"*. La gendarmerie, qui, pour le besoin de ses investigations, est amenée à ouvrir des conteneurs, a également fait procéder à des mesures par une antenne spécialisée, la Cellule nationale nucléaire radiologique biologique et chimique, à Versailles, et a décidé de protéger ses agents en les dotant de matériels spécifiques.

MESURES DRASTIQUES PRISES PAR LA BELGIQUE ET LES PAYS-BAS

Pour les syndicats, ces mesures sont insuffisantes et *"inadaptées"*. Surtout, elles ne s'appliquent pas à toute une chaîne de travailleurs qui manipulent chaque jour, dans l'ignorance du danger, les marchandises des conteneurs.

La Belgique et la Hollande ont pris des dispositions plus drastiques. Des protocoles entre employeurs et syndicats obligent à une mesure systématique des gaz dès qu'un doute apparaît. La douane hollandaise exige un certificat d'absence de gaz toxiques datant de moins de deux heures avant toute intervention de ses services. Jan De Jong, l'un des responsables du syndicat néerlandais FNV Bondgenoten, demande aux gouvernements d'aller plus loin en agissant à la source et en interdisant certains produits au niveau mondial.
Les syndicats préconisent l'installation de stations de dégazage dans les ports et l'intensification des contrôles. Qu'en est-il pour les entreprises ? Une enquête menée par le ministère de l'environnement hollandais, en 2006, avait montré que 97 % des société n'avaient procédé à aucune analyse des risques liés à la fumigation. Depuis, certaines entreprises, comme Ikea, mesurent systématiquement la toxicité de leurs conteneurs et de leurs meubles.
En France, le Syndicat national des agents des douanes CGT s'apprête à lancer une alerte sanitaire. Aucune étude épidémiologique ne permet à ce jour de mesurer l'effet de ces gaz sur la santé des travailleurs exposés.

Bruker's SIGIS 2 Identifies Multiple Airborne Chemical Compounds From Distances Up to 10 km

Source:http://www.domesticpreparedness.com/Industry/Industry_Updates/Bruker%60s_SIGIS_2_Identifies_Multiple_Airborne_Chemical_Compounds_From_Distances_Up_to_10_km/

Ideal for emergency first responders, stadium security and large crowd monitoring, Bruker Corporation's SIGIS 2 automatically identifies multiple airborne chemical compounds at distances of up to 10km. Utilized by numerous European civil protection agencies for events including FIFA World Cup, G8 Summit, NATO Summit and EURO Championships, SIGIS 2 provides an added level of monitoring the atmosphere for the presence of over 400 compounds and gases. The SIGIS 2 provides the ability to immediately – and remotely – identify released compounds and permits the emergency response personnel to take the appropriate actions, if warranted. Referencing an extensive library of compounds, including VOCs, TICs and CWAs, SIGIS 2 identifies the presence of potentially hazardous materials in the atmosphere from a safe distance, without exposing the user or the measurement device to the chemical being measured. Going beyond the capabilities of simple detection instruments, SIGIS 2 permits real time identification of the chemicals or compounds within the region measured. Even with multiple materials present in the region that is measured, SIGIS 2 will identify each material present within the single measurement area.
The SIGIS 2 developer, Dr. Roland Harig, states that "SIGIS 2 provides unambiguous identification and, using the power of FTIR spectroscopy, yields the lowest detection limits while providing simultaneous quantification and an easily interpreted visual image of the measured field."
The SIGIS 2 offers a unique, intuitive user interface that presents a minimally trained user with system control from a single screen, including the definition of the area within the field of

view to be evaluated. The SIGIS 2 platform is easily adapted for immediate mobilization as

different detection scenarios arise by incorporating a robust spectrometer based on Bruker RockSolidTM FT-IR interferometer platform, fast infrared detection technology and remote battery power. Equipped with programmable rotation capability of the measurement head, SIGIS 2 allows a 360º surveillance area to be imaged and characterized. Multiple units used simultaneously permit triangulation and the production of a tomographic reconstruction of the area of interest. Standard daylight and IR video cameras provide real-time display of the scene under any lighting conditions and are overlaid in real time with false color images of the detected gases. Using this feature, a direct display of the size and location of the chemical cloud is available for immediate assessment.

Visiongain Brings Out Chemical, Biological, Radiological and Nuclear Market Study

Source: http://www.laserfocusworld.com/news/2013/01/29/visiongain-brings-out-chemical-biological-radiological-and-nuclear-market-study.html

The market for defence against chemical, biological, radiological and nuclear threat is set to reach over $8.7bn in sales in 2013, new research has calculated, according to a release from Visiongain.

In a release, the Company noted that analysts say that global spending on radiation and chemical warfare agent detectors, protective CBRN suits and decontamination systems are

expected to rise by 8 percent on their 2012 levels.

With budgets under pressure in America as sequestration still looms on the horizon and withdrawal from foreign commitments becomes a reality, areas of growth in defence spending are few and far between. In Europe states are struggling to stay out of recession and public expenditure is being slashed. In this context Visiongain's report Global CBRN Defence Market 2013-2023: Chemical, Biological, Radiological and Nuclear Detection Equipment examines how manufactures are making the most of a surprisingly buoyant CBRN outlook and investigates the range of factors driving demand amongst governments.

In the report Visiongain examines the prospects for further growth in the market, producing detailed ten-year budget forecasts for the 20 leading countries and outlining the products, services and strategies of 30 of the most successful companies in the CBRN defence market.

The Visiongain analyst said, "Despite continued downward pressure on CBRN defence budgets on both sides of the Atlantic, we're seeing evidence that spending in the market is continuing to grow. This is partly due to the entrenched nature of CBRN defence spending in the biggest national markets; spending growth has been so strong in the past that large sums can be 'saved' from future budgets while nonetheless maintaining budget increases year to year. This means that any decline in American emphasis on CBRN defence will be felt only extremely gradually.

In addition to this cushion on slowing CBRN growth, many emerging economies are increasing their spending on CBRN defence exceptionally quickly. Whether by improving the protective equipment available to their military or by implementing the surveillance and contingency planning necessary to host international events, countries like India, China and Brazil will all contribute to strong growth in the global CBRN defence market.

An unfortunate further driver of CBRN defence spending in 2013 is likely to be the continuing collapse of the Syrian state, whose stockpiles of chemical weapon agent are of increasing concern to the country's neighbours."

The report has 186 pages and contains 238 tables, charts and graphs to explain trends and market projections within the CBRN defence market. As well as a global outlook, Visiongain provides forecasts and analysis for 20 leading national markets (plus the 'Rest of the World' market) and 4 global submarkets for the period 2013-2023, CBRN Detection, CBRN Protection, CBRN Decontamination and CBRN Simulation. The report also provides profiles of 30 companies operating in the CBRN defence market worldwide and an interview with company Environics UK.

The Global CBRN Defence Market 2013-2023: Chemical, Biological, Radiological and Nuclear Detection Equipment report is an invaluable reference for current and future investors in CBRN detection, simulation, protection and decontamination technology, as well as to companies and researchers who need to quickly understand the direction of both market and policy.

Toward a better cyanide antidote for terrorist attacks and other mass casualty events

Source:http://portal.acs.org/portal/acs/corg/content?_nfpb=true&_pageLabel=PP_ARTICLEMAIN&node_id=223&content_id=CNBP_032063&use_sec=true&sec_url_var=region1&__uuid=4cc1dbe4-700e-47c4-9f2b-b8d83151e6e2

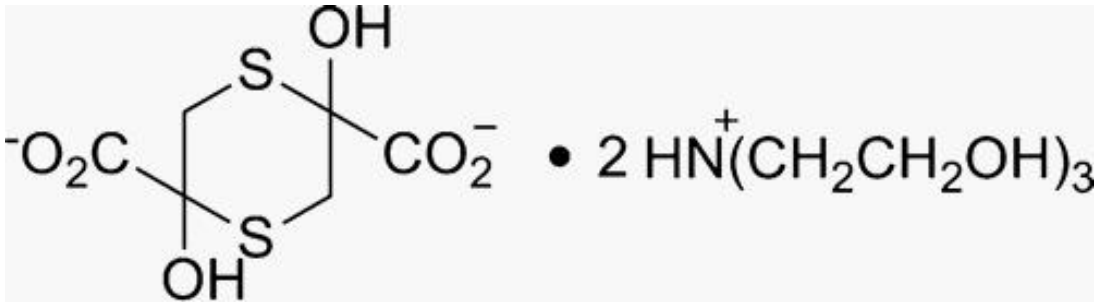
In an advance toward closing a major gap in defenses against terrorist attacks and other mass casualty events, scientists are reporting discovery of a promising substance that could be the basis for development of a better antidote for cyanide poisoning. Their report, which describes a potential antidote that could be self-administered, much like the medication delivered by allergy injection pens, appears in ACS' *Journal of Medicinal Chemistry*.

Steven E. Patterson, Ph.D., and colleagues at the University of Minnesota Center for Drug Design

explain that the only existing antidotes for cyanide — recognized as a high-risk substance for potential use by terrorists — must be administered by intravenous infusion. That procedure requires highly trained paramedical personnel and takes time. Cyanide, however, is a fast-acting poison. In a situation involving mass casualties, only a limited number of victims could be saved. Patterson's team thus sought an antidote that could be administered by intra-muscular (IM) injection, a simpler procedure that could be administered rapidly to a large number of victims or even be self-administered.

Their report describes discovery of a substance, sulfanegen TEA, "which should be amenable for development as an IM injectable antidote suitable for treatment of cyanide victims in a mass casualty setting. Further development, including efficacy in lethal cyanide animal models, will be reported at a later date."

Abstract



Current cyanide antidotes are administered by IV infusion, which is suboptimal for mass casualties. Therefore, in a cyanide disaster, intramuscular (IM) injectable antidotes would be more appropriate. We report the discovery of the highly water-soluble sulfanegen triethanolamine as a promising lead for development as an IM injectable cyanide antidote.

J. Med. Chem.

Russia starts destruction of 'complex' chemical munitions

Source: http://www.interfax.com/newsinf.asp?id=392265

A system to destroy so-called complex chemical munitions has been launched at the **Leonidovka chemical weapons disposal facility** in the **Penza** region.

"These munitions are special in that they contain not only a chemical agent, but also an explosive substance provided with an anti-disturbance device," Col. Gen. Valery Kapashin, the chief of the Federal Directorate for Safe Storage and Disposal of Chemical Weapons, who personally supervised the launch of the new system, told Interfax-AVN on Thursday.

The adjustment operations conducted in December 2012 and the first day of the system's operation in the nominal mode have proven high efficiency and safety of the complex chemical munitions disposal technology developed by Russian researchers, he said.

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Protecting Chemical Facilities Against Terrorist Attack

Source:http://www.domesticpreparedness.com/Infrastructure/Building_Protection/Protecting_Chemical_Facilities_Against_Terrorist_Attack/

The U.S. Department of Homeland Security (DHS) Appropriations Act of 2007, passed by Congress in 2006, authorized the secretary of that department to establish a regulatory program to oversee the security of chemical facilities considered at high risk for terrorist attack. In the spring of 2007, the Chemical Facility Anti-Terrorism Standards (CFATS) program was born.

Using his/her authority to evaluate the risk levels of chemical facilities, the secretary determines the nature and likelihood of a potential threat based on an operational definition of a chemical facility and the possession of a "screening threshold quantity" (STQ) of specific chemicals of interest (COI). The COI list (found in CFATS Appendix A, 6 CFR Part 27) includes the chemicals that, if released during a terrorist attack, would pose a threat of fire, explosion, and/or toxic exposure to the local community. Other chemicals are also included on the COI list that, if stolen or misdirected, could be used to manufacture explosive devices or chemical munitions for a subsequent attack.

The STQs are established at a level commensurate with the specific risk of the chemical, meaning that a high-risk chemical facility might not be a theoretically "typical" chemical manufacturing or distribution center. Any facility, in fact, that is home to a COI at or above the STQ limit could be declared a high-risk chemical facility. For that reason, the current facility list includes (but is not limited to) such disparate facilities as university laboratories, food processing plants, and agricultural complexes.

Risk Also Based on Location

The impact of a terrorist attack that includes the release of a certain quantity of a toxic chemical would vary to some extent according to the location of the chemical facility. For example, the effects of a 10,000-lb. release of anhydrous ammonia would be more serious in an urban area than on a Kansas farm, a consideration that puts the urban target at higher risk of an attack than the agricultural target.

In 2007, to evaluate the comparative risks based on location, DHS established the Chemical Security Assessment Tool's Top-Screen program, which requires any facility that possesses a COI at or above the STQ level to submit certain information to the department's Infrastructure Security Compliance Division (ISCD) – specifically including the maximum amount of each COI on hand within the past 60 days – along with certain basic information about the location of the facility. After reviewing the data submitted, the ISCD makes a preliminary determination of the high-risk status of the facility.

The need for that information quickly became evident. DHS Under Secretary Rand Beers stated in Senate testimony on 3 March 2010 that, when the first Top-Screens were received – in December 2007 and January 2008 – nearly 38,000 facilities had submitted their reports, and over 7,000 of them were notified that they might be at high risk for a terrorist attack. The other facilities were informed that their risks did not meet the criteria established for participation in the CFATS program – but were also advised that, if their COI inventory changed, they would have to submit a new Top-Screen.

Information Protection & Vulnerability Assessment

Once designated as a high-risk facility, that facility then must provide additional and more detailed information to ISCD. To ensure that the business and security information provided in the submissions is protected from disclosure by the government, Congress also required the DHS secretary to develop an "information protection" program that would exempt, from various federal disclosure rules, the information provided by the facilities participating in the program.

In response, DHS developed in 2006 a new Chemical-Terrorism Vulnerability Information program to protect the information provided to ISCD under the CFATS program from disclosure under the Freedom of Information Act. In court proceedings, therefore, such information receives protection similar to that afforded

classified information – but there also are some provisions included that permit information sharing with state and local emergency response officials.

To make a final determination that the initially designated facilities would actually be at a high threat of terrorist attack, DHS requires the submission of additional facility information under what is called a Security Vulnerability Assessment. Such assessments, which are submitted via another secure application in the Chemical Security Assessment Tool, provide ISCD with additional information about the facility layout, chemical storage, and safety/security systems.

After analyzing the Security Vulnerability Assessment data, ISCD makes a final determination of whether or not a specific facility is at high risk of terrorist attack, then assigns the facility to one of the four risk tiers – tier one being the highest risk and tier four the lowest. The tier ranking is important because the standards for the facility security measures are tied to that ranking.

Standards, Plans, Metrics & Guidelines

When Congress authorized the CFATS program, it included a provision that prohibited the DHS secretary from requiring any specific security measures for the approval of a site security program. To comply with that requirement, DHS incorporated into the CFATS regulations a list of 18 Risk-Based Performance Standards (RBPS) that must be met for a security plan to be approved.

In 2009, ISCD also published an RBPS Guidance document that provides additional information about not only the standards mandated but also the types of protection measures that may be appropriate for meeting those standards. The Guidance also provides a series of security metrics for each RBPS, based on the tier ranking of the facility, that spell out the difference in the requirements that must be met for each of the standards postulated.

CFATS-covered facilities are required to submit their security plans to ISCD for approval – by, for example, using a Site Security Plan (SSP) application in the online Chemical Security Assessment Tool. The SSP application provides a series of questions that the facility must answer about its current security processes, planned security measures, and proposals for future improvements.

Slow Progress – But Improvements Promised

Analysts at ISCD headquarters review the SSP submissions to determine if the measures planned are adequate to protect the facility in accordance with the RBPS for the appropriate tier ranking. If it is determined that those standards are in fact met, ISCD then: (a) authorizes the facility to implement the plan; (b) sends chemical facility security inspectors to the site to review the implementation process; and (c) approves the SSP – but not until *after* the inspectors report that the plan is in fact being properly implemented.

The step-by-step submission, authorization, and inspection process has proven, however, to be much more difficult and time-consuming than DHS had anticipated. In fact, according to the latest testimony (on 11 September 2012) of Beers before a subcommittee of the House Energy and Commerce Committee: (a) More than 3,600 facilities had by that time received final notification of their high-risk status and tier rankings; but (b) only 73 facility SSPs had been authorized as of that date; and (c) only one had been approved. David Wulf, Director of the Infrastructure Security Compliance Division, reported on 17 January 2013 that DHS is currently working on various procedures and process changes that will enable the authorization and approval rate to be significantly improved.

The chemical security program authorized by Congress in 2006 was intended to be an interim solution while Congress considered and approved a more comprehensive program. That has been more politically difficult than initially expected. Meanwhile, though, the continued authorization of the CFATS program has been renewed every year in the DHS appropriations bills. The current spending bill, and authorization for CFATS, expires on 27 March 2013.

Patrick Coyle *is a 15-year veteran of the U.S. Army and has worked for 17 years in the chemical process industry – including 12 years as a process chemist and one year as a quality assurance manager. He also has taught industrial safety, and has been a freelance writer since 2006. For the past six years he has used his unique*

background to write a chemical security blog: the "Chemical Facility Security News."

	1) Restrict Area Perimeter	2) Secure Site Assets	3) Screen and Control Access	4) Deter, Detect, and Delay	5) Shipping, Receipt, and Storage	6) Theft and Diversion	7) Sabotage	8) Cyber	9) Response	10) Monitoring	11) Training	12) Personnel Surety	13) Elevated Threats	14) Specific Threats, Vulnerabilities, or Risks	15) Reporting Significant Sec Events	16) Significant Sec Incidents \Activities	17) Officials and Organization	18) Records
Aircraft									X									
Assault Team	X	X	X	X	X				X			X						
Maritime	X			X					X									
Sabotage	X	X	X	X	X		X	X	X			X						
Standoff	X	X	X	X	X				X									
Theft/Diversion	X	X	X	X	X	X		X	X			X						
Vehicle Borne Improvised Explosive Device (VBIED)	X	X	X	X	X				X			X						

► **Read also:** http://www.dhs.gov/csat-site-security-plan and http://www.dhs.gov/xlibrary/assets/chemsec_cfats_riskbased_performance_standards.pdf

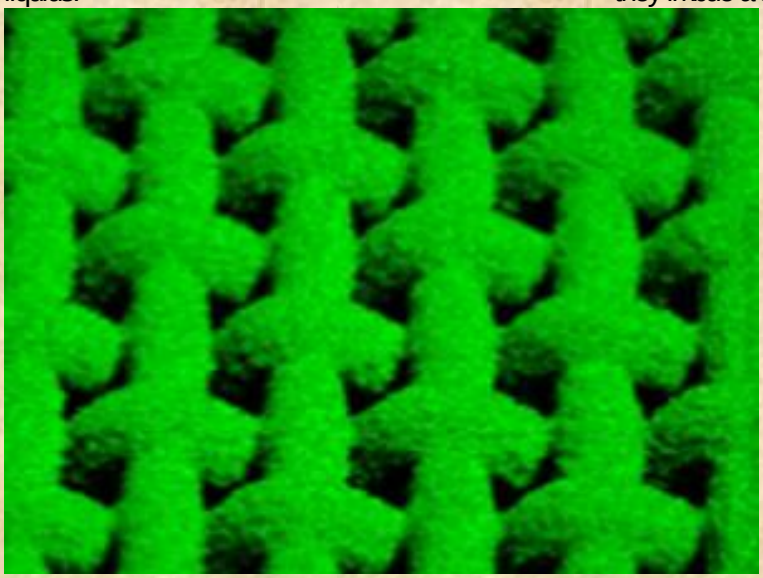
A Possible Answer For Protection Against Chemical / Biological Agents, Fuel Leaks, And Coffee Stains

Source: http://www.medicalnewstoday.com/releases/255758.php

A recent discovery funded by the Air Force Office of Scientific Research (AFOSR) may very well lead to a process that not only benefits every uniformed service member of the Department of Defense, but everyone else as well: protection from Chemical/Biological agents, to self-cleaning apparel, to effortless thermal management, to fuel purification as well as enhanced control of leaks - especially oil and fuels.

In 2006, AFOSR Program Manager Dr. Charles Lee funded Professor Gareth McKinley at the Massachusetts Institute of Technology exploring nanocomposite technology for Defense applications. Anish Tuteja, an MIT doctoral student at the time, was exploiting the unusual surface properties of a nanocomposite with fluorinated nanoparticles, to create a superoleophobic surface. After graduation, Tuteja moved to University of Michigan in Ann Arbor, where he is currently an assistant professor of materials science and engineering, specializing in chemical engineering and macromolecular science and engineering. He was awarded a Young Investigator Program grant from AFOSR in 2011, and continued to conduct the same line of research begun at MIT. His team also included doctoral student Shuaijun Pan and postdoctoral researcher Arun Kota, as well as collaboration with Dr. Joseph Mabry, from the Rocket Propulsion Division of the Air Force Research Laboratory, at Edwards AFB, California.

In their latest paper, "Superomniphobic Surfaces for Effective Chemical Shielding," in the current issue of the Journal of the American Chemical Society, Tuteja and his team have demonstrated surfaces that effectively perform as "chemical shields against virtually all liquids."



To make this possible, surfaces are prepared using a nanoscale coating that is approximately 95 percent air, which in turn, repels liquids of any material in its class, causing them to literally bounce off the treated surface. The surfaces "possess hierarchical scales of re-entrant texture that significantly reduce the solid - liquid contact area." It all comes down to controlling how much contact the liquid ultimately has with the treated surface. To accomplish that the researchers apply the nanoscale coating using a process called electrospinning - using an electric charge to create fine particles of solid derived from a liquid solution.

The coating is a mixture of cross-linked "polydimethylsiloxane," or PDMS, and liquid-resisting nanoscale cubes developed by the Air Force that contain carbon, fluorine, silicon and oxygen. While the material's chemistry is important, so is its texture, because it hugs the pore structure of whatever surface it is applied to, and creates a fine web of air pockets within those pores, so any liquid that comes in contact with the coating is barely touching a solid surface.

According to Dr. Tuteja, when an untreated surface and a liquid get in close proximity, "they imbue a small positive or negative charge on each other, and as soon as the liquid comes in contact with the solid surface, it will start to spread... we've drastically reduced the interaction between the surface and the droplet." By effectively eliminating the contact between the treated surface and the liquid, there is almost no incentive for the liquid to spread, as such, the droplets stay intact, interacting only with molecules of themselves, and maintaining their spherical shape.

The research team has tested more than 100 liquids and found only two that were able to penetrate the coating: they were both chlorofluorocarbons - chemicals used in refrigerators and air conditioners. In Tuteja's lab demonstrations the surface repelled coffee, soy sauce and vegetable oil, as well as toxic hydrochloric and sulfuric acids, and the surfaces are also resistant to gasoline and various alcohols.

This program is of particular interest to the Air Force and the Department of Defense, as it can be useful for self-cleaning surfaces (in particular, integral breathable protective Chemical/Biological Warfare defense in uniform clothing and sensor systems), improvement of thermal management efficiency in phase change cooling systems, fuel purification and the control of oil and fuel leakages in rockets and airplanes. Not to mention, protection against the everyday coffee spill.

Keeping an eye on the world's dangerous chemicals

Source:http://www.homelandsecuritynewswire.com/dr20130220-keeping-an-eye-on-the-world-s-dangerous-chemicals

In the chemistry labs of the developing world, it is not uncommon to find containers, forgotten on shelves, with only vague clues to their origins. The label, if there is one, is rubbed away.

Left alone for years, some chemicals can quietly break down into explosive elixirs, and what was once an innocent experiment by a well-meaning scientist becomes a very real, unsecured threat. Should such chemicals fall into malicious hands, the consequences could be widespread and deadly.

In 2007 Sandia chemical engineer Nancy Jackson helped the U.S. Department of State create the Chemical Security Engagement Program to help scientists around the world, particularly in developing countries, keep chemical use safe and secure. Jackson and her team develop and implement programs for laboratories worldwide to help manage their chemical inventories and devote time to training future laboratory trainers.

A Sandia Lab release reports that Jackson, as the 2011 president of the American Chemical Society and manager of Sandia's International Chemical Threat Reduction program, has traveled and worked closely with scientists in some of the world's most volatile regions to make their laboratories more safe and secure. For her extensive work engaging scientists around the world, the American Association for the Advancement of Science has honored Jackson with the 2013 Science Diplomacy Award, which was presented on Friday, 15 February, at the American Association for the Advancement of Science (AAAS) annual meeting in Boston.

"Nancy has been a true pioneer in chemical threat reduction work globally. Even though the chemical threat has not received all the attention that the biological threat has, the ubiquity of dangerous chemicals and the means to misuse them makes the danger of chemical terrorism and proliferation just as clear and present as the biological threat," said Ren Salerno, senior manager of Sandia's International Cooperative Threat Reduction program. "The recent crisis in Syria emphasizes this reality. The work of Nancy and her department is unquestionably a critical Sandia contribution to U.S. and international security."

The program's goal is identifying chemicals that can cause catastrophe in the wrong hands, and making sure they stay out of those hands. The release noes that one challenge facing Jackson and her team is that many laboratory chemicals are dual use, with both helpful and destructive applications. Take potassium cyanide. While cyanide is used to manufacture plastics, textiles, and paper, develop photographs and remove gold from its ore, when paired with an acid, cyanide can easily be turned into a deadly gas.

"Chemicals are not like nuclear or biological threat materials. They are everywhere," said Jackson. "You can't lock them up; you can't put them in Biosecurity Level 4 labs. Instead of locking them up, you have to manage them."

Jackson and her team work with universities, small businesses, and research institutions to build extensive chemical inventories so organizations can know and manage what they have. With such inventories, chemicals are less likely to go missing, and sharing resources between scientists is easier, driving down costs and wait times associated with ordering new products.

The program regularly engages scientists in the Middle East and Southeast Asia, where Jackson says chemists and chemical engineers understand the importance of keeping chemicals guarded, but often do not have the resources or training to implement security systems.

Jackson and her team have developed five-day, train-the-trainer programs for chemists and chemical engineers that teach the importance of personal protective equipment, maintaining working chemical hoods, chemical management and physical security. The goal is to educate professors and researchers so that program graduates will be aware of safety and security measures, thus sustaining the program for future graduates.

Despite the important national security mission of Jackson's work, she said one of the most rewarding aspects of her job is building relationships, particularly with the growing population of female chemists and chemical engineers in the developing world. "It's a delight," Jackson said. "I love meeting these very impressive people and getting to know them, and I try to help their careers however I can. It has been a very rewarding career and I am honored to be recognized for my work."

Detecting Chemical Warfare Agents on Surfaces

By James A. Laramée, H. Dupont Durst, Theresa R. Connell, and J. Michael Nilles

American Laboratory, (Volume 40, Number 16), pp. 16 – 20 "Detection of Chemical Warfare Agents on Surfaces Relevant to Homeland Security by Direct Analysis in Real-Time Spectrometry"

Source: http://news.cbrnresourcenetwork.com/newsDetail.cfm?id=147

Analysis of low-volatility, condensed-phase chemicals on surfaces has been an extremely difficult and long-standing objective in environmental monitoring. When target analytes possess pico-torr vapor pressures, the problem of monitoring becomes formidable. As such, any noncontact sampling at atmospheric pressure that does not require solvents or wipes would be a technological breakthrough. In addition, the absence of sample preparation would allow extremely rapid analysis in time-critical situations. Today, such a technology is now available. It is known as Direct Analysis in Real Time(1) or DART™(JEOL USA, Inc., Peabody, MA).

The U.S. Army has been testing and developing DART since 2002 for the detection of chemical warfare agents on surfaces. Fast, safe, and accurate detection of chemical agents is critical for protection, security, and decision-making. Sample preparation is seldom a requirement with DART, since the contaminated surface is simply analyzed directly using a plume of gaseous Rydberg atoms. Unlike other analytical methods that necessitate that the surface be sprayed with electrically charged solvents,(2) or that require solvent extraction, DART leaves the sample surface undisturbed. This is a forensically worthy advantage. Recent findings of chemical warfare agent detection on militarily relevant surfaces in Homeland Security is a new approach to Warfighter safety and counter-terrorism.

Experimental

The DART source

The use of Rydberg atoms as a replacement for the radioactive source in chemical agent monitors was conceived by Dr. James A. Laramée in 2001. A working prototype was developed by Drs. Cody and Laramée, which was publicly disclosed on April 14, 2003 in two patent applications as the first ambient mass spectrometric method.(3)

DART/AccuTOF™ system

The experimental apparatus consisted of three practically identical DART/AccuTOF (JEOL USA) systems, which were used in unison to give multiple checks. The DART source consists of a tube divided into three chambers through which a gas, typically helium, flows. A needle in the first chamber is electrified to a few kilovolts to form a plasma that consists of helium cations, electrons, and excited-state species, which are the working reagent in the DART method. The second and third chambers contain electrodes to remove most of the ionic species from the gas stream. Detailed operating parameters have been described elsewhere. The gas flow and electrode potentials have a broad range of operating values that are not critical to the information fidelity of the experiment. Many combinations of settings gave similar sensitivity. Mass spectra were recorded on a modified AccuTOF time-of-flight mass spectrometer (model JMS-100TLC) operating at 6000 mass resolution (FWHM definition). The sampling orifice was set to 60 V relative to ground in order to attract the analyte ions into the spectrometer. Higher orifice voltages were used when fragmentation of the molecular cation was desired.

Chemicals

Chemical Agent Standard Reference Materials (CASARM) were used: O-ethyl N,N-dimethylphosphoramidocyanidate (GA), O-isopropyl methylphosphonofluoridate (GB), bis-(2-chloroethyl) sulfi de (HD), and O-ethyl S-2-diisopropylaminoethyl methylphosphonothiolate (VX). The Chemical Weapons Convention allows development, production, acquisition, stockpile, or possession of these chemicals and their transfer, directly or indirectly, only to treaty declared facilities and private facilities with bailment agreements.(4)

Results and Discussion

A meaningful chemical warfare agent detector must fulfill three criteria in order to be useful. First, the technology must be able to detect actual agents and not just simulants; although

simulants are popular in academic laboratories, they give meaningless evaluations of detection capability. Second, trace-level concentrations must be detectable regardless of their physical state. Third, chemical warfare agents must be detectable regardless of the nature of the sample surface that holds them. The DART technology was tested with these constraints in mind.

Exact mass measurements of the major peaks in the mass spectrum were made in order to assign correct and unambiguous elemental compositions. The average mass accuracy of the measurements was ±0.00004 Da. By way of contrast, the instrument manufacturer claims a mass accuracy of ±0.002 Da and recently reported peaks in agreement with predicted values of less than or equal to 0.007 Da with even larger deviations observed at masses below 200 and above 600 Da.(5) This instrument behavior has not been observed on any of the authors' three DART/AccuTOF systems, which they attribute to careful operation and setup, both of which appear to be essential for obtaining meaningful exact mass measurements.

VX was spiked onto various sample surfaces collected from an urban environment. Eight hundred nanograms of VX (in isopropyl alcohol) was applied to 20 surfaces and analyzed. None of the surfaces tested were treated or cleaned up in any way. These included aluminum, roadway asphalt, automobile tail light, birch tree bark, cardboard, two types of concrete (foreign and domestic), glass, holly leaf, bird feather, waxed paper cup, paper towel, clothing fabric, stainless steel, rusted steel, plastic, tire tread rubber, roofing tile, and a Viton® (DuPont Performance Elastomers L.L.C., Wilmington, DE) O-ring. Difficult sample surfaces were readily analyzed, such as porous concrete, electrical conductors, and biological samples. The protonated molecular cation at *m/z* 268.150 appeared within seconds and with little fragmentation. Only a small peak at m/z 128.144 corresponding to the diisopropyl aminoethyl cation fragment ($C_8H_{18}N$) was seen. This soft ionization is an advantage of the DART ion source over other methods for the detection and identification of chemical warfare agents, since the mass spectra remain uncluttered by extraneous peaks. Ion intensities were typically greater than several hundred thousand counts, with signal-to-noise ratios in excess of 100,000.

One of the best features of DART is that it is not overwhelmed by the presence of background environmental impurities such as salt, soil constituents, plant carbohydrates, degraded proteins, etc. It is particularly significant that analytes of interest that are absorbed into salt can be directly analyzed without sample preparation. This has yet to be demonstrated by other analytical techniques such as nuclear magnetic resonance (NMR) spectroscopy, electrospray ionization (ESI) or desorption electrospray ionization (DESI), or gas chromatographymass spectrometry (GC-MS), to name a few. Deicing salt crystals were gathered from a local roadway. They were then spiked with 30 ng of VX and directly analyzed. A prominent (MH+NH3)+ molecular cation was observed instead of the usual MH+ cation because this sample contained ammonium impurities. Other peaks in the spectrum are due to environmental impurities on the salt crystal.

The nerve agent ethyl N-dimethylphosphoramidocyanidate (GA) was also studied. Three hundred nanograms of GA was deposited onto four worker incident surfaces (laboratory coat, protective rubber glove, laboratory notebook, and a cotton swab), and nine representative materials of construction (window glass, nylon rug, muddy automobile taillight, concrete, roadway asphalt, acorn shell, latex painted drywall, newspaper, and roof shingle). An abundant protonated molecular cation at m/z 163.063 was seen for all of the surfaces examined. A fragment peak at m/z 135.032 corresponding to the [MH–C2H4]+ ion is also evident and strongly dependent on orifice 1 voltage. Average mass error for GA on these surfaces was ±0.00007 Da (n = 117). Signal-to-noise ratios per sample were 1300 for acorn; 20,000 for rug; 24,000 for concrete, and 31,000 for rubber glove. Recoveries were 90% from glass, 82% from asphalt, and 36% from concrete.

Detection sensitivity of chemical agents on surfaces was estimated using steel, rubber hose, concrete, and charcoal. These surfaces were spiked with 1000, 100, 10, 1, and 0.5 ng of GB, HD, VX, and GA chemical agents. All of the surfaces were taken in situ rom the environment and none were cleaned or modified in any way. For example, the concrete came from an active military airfield and the rubber hose was part of a life-support system (LSS). Each sample surface was inserted into the DART beam in order to record a control spectrum. The surface was then spiked with chemical agent and its mass spectrum measured again. Linear calibration curves were obtained, which are the subject of a forthcoming paper. Ten nanograms of the chemical agents gave high-fidelity spectra. Background peaks at the same nominal mass of the chemical agent were distinguished from the chemical agent peak by exact mass measurement. For example, GB has an exact mass of

158.075 Da, which is clearly distinguished from the background peak at 158.131 Da on the steel surface. A false positive test result would have resulted had exact mass measurements not been made. Signal-to-noise ratios provide another way to express detection sensitivity. Five hundred picograms of chemical agent were spiked onto charcoal, concrete, LSS rubber hose, and steel. The steel surface gave a signal-to-noise (S/N) ratio greater than 600 for all of the agents, whereas the other more absorbent surfaces gave diminished responses, as expected. The most volatile chemical agents, GB and GA, were least affected by surface porosity, giving nearly identical S/N ratios for the surfaces examined. VX is the most nonvolatile of the chemical agents examined and gave the smallest S/N ratio for absorptive surfaces.

Conclusion

DART is a new way to identify and confirm low concentrations (500 pg/25 mm^2) of chemical warfare agents on relevant surface materials of construction. Useful analytical information is gained about surface contamination, regardless of the surface's composition, nature, or cleanliness. Electrically conductive samples can be analyzed as easily as electrical insulators. Porous building materials are as amenable to DART analysis as impermeable roofing tiles. In fact, no surface has yet been found that could not be analyzed by DART. DART does not require a spray of toxic or flammable solvents, unlike other ambient mass spectrometric methods. Exact mass measurements reduce the likelihood of a false positive result.

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(4) Preparatory Commission for the Organization for the Prohibition of Chemical Weapons, Tenth Session of the "Expert Group on Inspection Procedures," Apr 3–7, 1995. Document number PC-X/B/WP.9.
(5) Kpegba, K.; Spadaro, T.; Cody, R.B.; Nesnas, N.; Olson, J.A. Analysis of self-assembled monolayers on gold surfaces using direct analysis in real time mass spectrometry. Anal. Chem. Corr. 2007, 79, 5479–83.

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Syria Dropped Hallucinogen Weapon on Rebels, Secret Cable Says

Source: http://www.wired.com/dangerroom/2013/01/syria-agent-bz/

The Syrian military used an exotic chemical weapon on rebels during an attack in the city of Homs, some U.S. diplomats now believe.

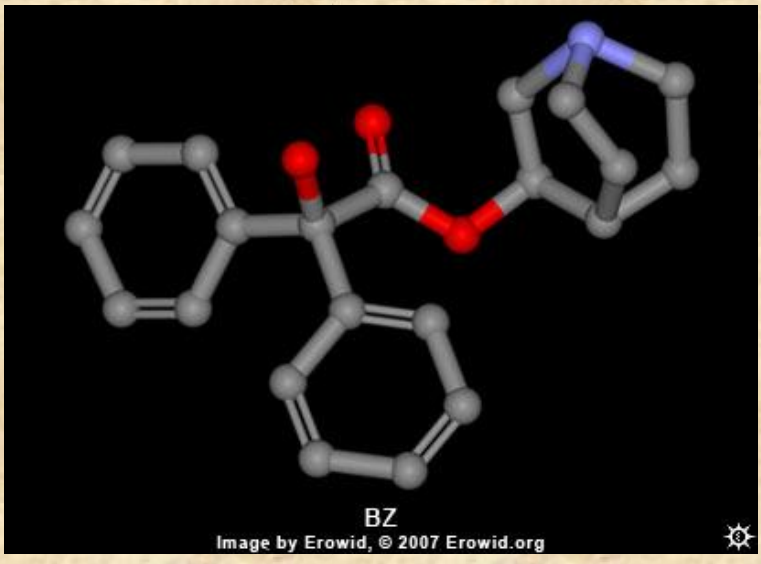
That conclusion — first reported by *Foreign Policy's* Josh Rogin and laid out in a secret cable from the U.S. consul general in Istanbul — contradicts preliminary estimates made by American officials in the hours after the December 23 strike. But after interviews with Syrian activists, doctors, and defectors, American diplomats in Turkey have apparently rendered a different verdict. It's important to note, however, that this was the conclusion of a single consulate within the State Department, and there is still wide disagreement within the U.S. government over whether the Homs attack should be characterized as a chemical weapons incident.

"We can't definitely say 100 percent, but Syrian contacts made a compelling case that Agent 15 was

used in Homs on Dec. 23," an unnamed U.S. official tells Rogin.

Agent 15 is similar to 3-quinuclidinyl benzilate or BZ, a powerful hallucinogen that the

American military tested out on its own soldiers during the Cold War. Its emergence on the



Syrian battlefield would be nothing short of bizarre. While Syria is well-known to have a massive supply of chemical weapons, international observers haven't ordinarily included BZ on that list.

Over the years, there have been rumors of BZ being used on a battlefield — including one that Iraqi insurgents were dosing themselves with the drug to pump up their aggressiveness. If the cable is accurate, this would be the first confirmed case of BZ employed as a weapon. At the moment, however, the cable's claims are not confirmed.

"The reporting we have seen from media sources regarding alleged chemical weapons incidents in Syria has not been consistent with what we believe to be true about the Syrian chemical weapons program," White House national security council spokesman Tommy Vietor said in a statement. "If the Assad regime makes the tragic mistake of using chemical weapons, or fails to meet its obligation to secure them, the regime will be held accountable."

President Obama has called the use of chemical arms in Syria a "red line" that could trigger outside intervention in the civil war that has killed more than 60,000 people. It's unclear whether the White House would consider a BZ strike to be a step over that line; Agent 15 isn't nearly as deadly as a nerve agent like sarin. Last week, America's top military officer said preventing a chemical attack by the Assad regime

would be "almost unachievable."

American and allied intelligence services have been watching the Syrian government's

acquisition and possible use of chemical weapon components for years. They've blocked the importation of precursor chemicals and equipment into Syria when they've been able, and immediately reported to the White House when the Syrian military began mixing those precursor chemicals and loading them into munitions for a possible attack.

But when U.S. officials first caught wind of Syrian rebels' chemical weapons claim, the officials didn't make much of it. In graphic videos uploaded to YouTube, opposition activists said they were hit by a gas that was "something similar to sarin," a deadly nerve agent. The videos showed victims howling in agony and barely able to breathe. But the symptoms, as gruesome as they were, didn't seem like the one produced by sarin.

There were complaints of strong smells in the videos; sarin is often odorless. There were reports that the victims inhaled large amounts of the chemical; a minuscule of amount of inhaled sarin can be fatal.

"It just doesn't jibe with chemical weapons," one U.S. official told Danger Room at the time.

Later accounts from Homs more closely match what one might expect from a nerve gas victim. Rogin spoke with Dr. Nashwan Abu Abdo, a neurologist from Homs, who talked about victims with pinpoint pupils, "choking on their own secretions."

Abdo's descriptions, however, don't correspond with the conclusions of the State Department cable. A hallucinogen like BZ is unlikely to produce the effects Abdo outlined; such drugs typically cause pupils to grow, for instance, not contract.

Something horrible happened in Homs on December 23. Exactly what that horrible event was still isn't clear.

Chemical and Biological Weapons: Possession and Programs Past and Present

Source: http://cns.miis.edu/cbw/possess.htm

This chart summarizes data available from open sources. Precise assessment of a state's capabilities is difficult because most weapons of mass destruction (WMD) programs were, and/or are, secret and cannot be independently assessed. States have been placed in the following categories:

- ***Known***- where states have either declared their programs or there is clear evidence of chemical or biological weapons possession.
- ***Probable***- where states have been publicly named by government or military officials as "probable" chemical or biological weapons possessors or as producing chemical or biological weapons.

- ***Possible***- where states have been widely identified as possibly having chemical or biological weapons or a CBW program by sources other than government officials.
- ***Former***- where states have acknowledged having a chemical or biological weapons stockpile and/or CBW program in the past.
- ***Weaponized Agents***- where agents are produced in quantity, and/or filled into munitions in a specialized formulation with enhanced shelflife or dissemination properties. The chart distinguishes between past and current activities.
- ***Research***- possible agents studied; no evidence of weaponization.

~ Only when countries are known to have weaponized agents is a distinction made between weapons and non-weapons research. In all other cases, the agents are classified as "possible" agents because not enough information is available to determine whether or not weaponization has occured.

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	Chemical				Biological			
Country	**Program Status**	**Possible Agents**	**Signed CWC[1]**	**Ratified CWC[1]**	**Program Status**	**Possible Agents**	**Signed BWC[2]**	**Ratified BWC[2]**
Algeria	Possible[3]	Unknown	01/13/93	08/14/95	Research effort, but no evidence of production[4]	Unknown	-	07/22/2001*
Canada	Former program[5]	-mustard -phosgene -lewisite[6]	01/13/93	09/26/95	Former program Started: 1941 Ended: 1945[7]	**Past Weaponized Agents** -anthrax **Research** -brucellosis -rocky mountain spotted fever -plague -tularemia -typhoid -yellow fever -dysentery -rinderpest -botulinum toxin -ricin[8]	04/10/72	09/18/72
China	Probable [9]	Unknown	01/13/93	04/25/97	Likely maintains an offensive capability[10]	Unknown	-	11/15/84*
Cuba	Possible[11]	Unknown	01/13/93	04/29/97	Probable research program[87]	Unknown	04/10/72	04/21/76

Egypt	Probable [12]	-mustard -phosgene -sarin -VX[13]	No	No	Likely maintains an offensive program[14]	Unknown[15]	10/04/72	No
Ethiopia	Probable [16]	Unknown	01/14/93	05/13/96	-	-	04/10/72	05/26/75
France	Former program[17]	-mustard -phosgene[18]	01/13/93	03/02/95	Former program Started: 1921 Ended: 1940 (dormant 1927-1934) 1940-1945 (German occupation)[19]	**Past Weaponized Agents** -potato beetle **Research** -anthrax -salmonella -cholera -rinderpest -botulinum toxin -ricin[20]	-	09/27/84 *
Germany	Former program[21]	-phosgene -hydrogen cyanide -mustard -tabun -sarin -soman[22]	01/13/93	08/12/94	Former program Started: 1915 Ended: 1945 (dormant 1919-1939)[23]	**Past Weaponized Agents** -glanders (WW 1) -anthrax (WW I) **Research** -foot and mouth disease -plague -rinderpest -typhus -yellow fever -potato beetle -potato blight [24]	04/10/72	11/28/72
India	Former program[25]	Unknown	01/14/93	09/03/96	Research program, but no evidence of production[26]	Unknown	01/15/73	07/15/74
Iran	Known[27]	-mustard -sarin -hydrogen cyanide -cyanogen	01/13/93	11/03/97	Likely maintains an offensive program[29]	-anthrax -foot and mouth disease -botulinum	04/10/72	08/22/73

		chloride - phosgene[28]				toxin - mycotoxins[30]		
Iraq	Former program[31]	-mustard -sarin -tabun -VX -Agent 15[32]	No	No	Former program[33]	**Past Weaponized Agents** -anthrax -botulinum toxin -ricin -aflatoxin -wheat cover smut **Research** -brucellosis -hemorrhagic conjuctivitis virus (Enterovirus 70) -rotavirus -camel pox -plague (?) -gas gangrene toxin[34]	05/11/72	06/19/91 **
	Chemical				**Biological**			
Country	**Program Status**	**Possible Agents**	**Signed CWC[1]**	**Ratified CWC[1]**	**Program Status**	**Possible Agents**	**Signed BWC[2]**	**Ratified BWC[2]**
Israel	Probable[35]	Unknown[36]	01/13/93	No	Research, with possible production of agents[37]	Unknown	No	No
Italy	Former program[38]	-mustard -phosgene[39]	01/13/93	12/08/95	-	-	04/10/72	05/30/75
Japan	Former program[40]	-phosgene -hydrogen cyanide -mustard -lewisite -chloropicri	01/13/93	09/15/95	Former program Started: 1931 Ended: 1945[42]	**Past Weaponized Agents** -anthrax -plague -glanders -typhoid	04/10/72	06/08/82

		n[41]				-cholera -dysentery -typhoid -paratyphoid **Research** -gas gangrene -influenza -tetanus -tuberculosis -tularemia -salmonella -typhus -glanders -tetrodotoxin[43]		
Libya	Former program[44]	-mustard -sarin -tabun -lewisite -phosgene[45]	-	01/06/04*	Possible former program Ended: 2003[46]	Unknown	-	01/19/82*
Myanmar (Burma)	Probable[47]	Unknown	01/14/93	No	-	-	04/10/72	No
N. Korea	Known[48]	-adamsite -mustard -hydrogen cyanide -cyanogen chloride -phosgene -sarin -soman -tabun -VX[49]	No	No	Research, with possible production of agents[50]	-anthrax -plague -yellow fever -typhoid -cholera -tuberculosis -typhus -smallpox -botulinum toxin[51]	-	03/13/87*
Pakistan	Probable[52]	Unknown	01/13/93	10/28/97	Possible[53]	Unknown	04/10/72	09/25/74
Russia	Probable[54]	-Novichok binary nerve agents[55]	01/13/93	11/05/97	Research, some work beyond legitimate	Unknown	04/10/72	03/26/75

					defense activities likely[56]			
Soviet Union	Former program[57]	-sarin -soman -mustard -lewisite -phosgene -VX analogue[58]	01/13/93	11/05/97	Former program Started: 1926 Ended: 1992[59]	**Past Weaponized Agents** -smallpox -plague -tularemia -glanders -Venezuelan equine encephalitis -anthrax -Q fever -Marburg **Research** -Ebola -Bolivian hemorrhagic fever -Argentinian hemorrhagic fever -Lassa fever -Japanese encephalitis -Russian spring-summer encephalitis -brucellosis -Machupo virus -yellow fever -typhus -melioidosis -psittacosis -rinderpest -African swine fever virus -wheat stem rust -rice	04/10/72	03/26/75

						blast[60]		
	Chemical				**Biological**			
Country	**Program Status**	**Possible Agents**	**Signed CWC[1]**	**Ratified CWC[1]**	**Program Status**	**Possible Agents**	**Signed BWC[2]**	**Ratified BWC[2]**
S. Africa	Former program[61]	-thallium -CR -paraoxon -mustard[62]	01/14/93	09/13/95	Former program Started: 1981 Ended: 1993[63]	-anthrax -cholera -plague -salmonella -gas gangrene -ricin -botulinum toxin[64]	04/10/72	11/03/75
S. Korea	Former program[65]	Unknown	01/14/93	04/28/97	-	-	04/10/72	06/25/87
Sudan	Possible[66]	Unknown	-	05/24/99*	Possible research interest[67]	Unknown	-	10/17/2003*
Syria	Known[68]	-mustard -sarin -VX	No	No	Research program, with possible production[69]	-anthrax -botulinum toxin -ricin[70]	04/14/72	No
Taiwan	Possible[71]	Unknown	N/A	N/A	Possible research program[72]	Unknown	04/10/72	02/09/73***
U.K.	Former program[73]	-phosgene -mustard -lewisite[74]	01/13/93	05/13/96	Former program Started: 1936 Ended: 1956[75]	**Past Weaponized Agents** -anthrax **Research** -plague -typhoid -botulinum toxin[76]	04/10/72	03/26/75
U.S.A.	Former program[77]	-mustard -sarin -soman -VX -lewisite -binary nerve agents[78]	01/13/93	04/25/97	Former program Started: 1943 Ended: 1969[79]	**Past Weaponized Agents** -Venezuelean equine encephalitis -Q fever -tularemia -anthrax	04/10/72	03/26/75

						-wheat rust -rice blast **Research** -brucellosis -smallpox -Eastern and Western equine encephalitis -Argentinian hemorrhagic fever -Korean hemorrhagic fever -Bolivian hemorrhagic fever -Lassa fever -glanders -melioidodis -plague -yellow fever -psittacosis -typhus -dengue fever -Rift Valley fever -Chikungunya virus -late blight of potato -rinderpest -Newcastle disease -fowl plague -staph enterotoxin B -botulinum toxin -ricin[81]		

Viet Nam	Possible[81]	Unknown	01/13/93	09/30/98	-	-	-	06/20/80*
Yugoslavia, Former Federal Republic of (FRY)	Former program[83]	-sarin -mustard -tabun -soman -VX -lewisite -BZ[84]	-	04/20/00*	None/Unknown[84]	-	04/10/72	10/25/73

*Denotes countries which acceded to the treaty.
** Iraq ratified the BWC following the adoption of U.N. Security Council Resolution 687, which in addition to establishing UNSCOM, also "invited" Iraq to ratify the 1972 Convention (Paragraph 7), 04/08/91, (http://www.un.org/Docs/scres/1991/scres91.htm).
*** The U.N. does not recognize Taiwan as an independant entity (from China), so their signature and ratification of the BWC in 1972, 1973 are not considered legitimate.

Resources

[1] Organization for the Prohibition of Chemical Weapons, "Membership of the OPCW," (http://www.opcw.org).

[2] "Status of the Convention," The Biological and Toxin Weapons Convention Website, (http://www.opbw.org).

[3] Anthony Cordesman, "The Proliferation of Weapons of Mass Destruction in the Middle East: The Impact on the Regional Military Balance," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p31.

[4] Algeria is reportedly conducting research into biological weapons, but there is no evidence of a production effort. Cordesman, *The Proliferation of Weapons of Mass Destruction in the Middle East*, 2005, p. 31.

[5] During World War II, Canada manufactured chemical munitions and purchased both lewisite and phosgene from the U.S. Army. In 1946, following the war, Canada destroyed its chemical weapons stockpile. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume II: CB Weapons Today*, (New York: Humanities Press, 1971), p. 187.
See also: John Bryden, *Deadly Allies: Canada's Secret War 1937-1947*, (Toronto, ON: McClelland & Stewart Inc., 1989).

[6] As part of its World War II chemical weapons program, Canada produced mustard gas and phosgene and procured quantities of mustard gas, lewisite, and phosgene from the United States. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume II: CB Weapons Today*, p. 187.

[7] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
Donald Avery, "Canadian biological and toxin warfare research, development and planning, 1925-45," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), pp. 197-214.
The Office of Technology Assessment includes Canada in a list of countries that have admitted to having had "offensive [biological] weapon munition supplies or development programs in the past." U.S. Congress, Office of Technology Assessment, *Proliferation of*

Weapons of Mass Destruction: Assessing the Risks, (Washington, DC: U.S. Government Printing Office, August, 1993), p. 63.
In 1942, the Canadians began collaborating with the United Kingdom's biological weapons effort. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume I: The Rise of CB Weapons* (New York, NY: Humanities Press, 1971), p. 118-119. *See also:* Bryden, *Deadly Allies: Canada's Secret War 1937-1947*.

[8] Donald Avery, "Canadian biological and toxin warfare research, development and planning, 1925-45," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), pp. 203-213.
Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume I: The Rise of CB Weapons*, p. 118-119.
In its work with the United States and the United Kingdom, Canada conducted research on several biological agents, including botulinum toxin, ricin, rinderpest virus, Rocky Mountain spotted fever, plague, and tularemia. The anthrax that Canada weaponized was done in partnership with both the United Kingdom and the United States. However, most of the research was done outside of Canada. John Bryden, *Deadly Allies: Canada's Secret War 1937-1947*, pp.108, 120, 210, 218, 223, 243.

[9] On March 19, 2002, in Testimony before the Senate Committee on Foreign Relations, Assistant Secretary of State for Intelligence and Research, Carl W. Ford, Jr. stated that "I believe that the Chinese have an advanced chemical warfare program, including research and development, production, and weaponization capabilities." Ford also stated that "In the near future, China is likely to achieve the necessary expertise and delivery capability to integrate chemical weapons successfully into overall military operations." Carl W. Ford, Jr., Assistant Secretary of State for Intelligence and Research, "Hearing on Reducing the Threat of Chemical and Biological Weapons Before the Senate Committee on Foreign Relations," (Washington, DC), March 19, 2002.
Rear Admiral Thomas Brooks, Director of Naval Intelligence, identified China as a "probable" chemical weapons possessor in testimony before Congress. Rear Admiral Thomas Brooks, Director of Naval Intelligence, statement before the Subcommittee on Seapower, Strategic and Critical Materials, U.S. Congress, House of Representatives, Committee on Armed Services, "Hearings on National Defense Authorization Act for Fiscal Years 1992 and 1993 before the Committee on Armed Services," 102[nd] Congress, Second Session, March 7, 1991, (Washington, DC: Government Printing Office, 1993), p. 107.
China was referred to by the U.S. Department of Defense as having "the ability to quickly mobilize the chemical industry to produce a wide variety of chemical agents and delivery means. " U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 14.
In a report to Congress on international compliance with arms control and nonproliferation agreements, the US Department of State found with respect to a potential Chinese CW program: "The United Sates judges that China maintains a CW production mobilization capability, although there is insufficient information available to determine whether it maintains an active offensive CW research and development program. Moreover, in violation of its CWC obligations, China has not acknowledged past transfers of chemical weapons and it may not have declared the full extent of its CW-related facilities." U.S. Department of State, "Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments," Washington, DC, August 30, 2005, (http://www.state.gov/t/vc/rls/rpt/51977.htm).
An article in *The Economist* suggests that China might "have destroyed [its] chemical weapons before signing the CWC." "Chemical Weapons. Just Checking," *The Economist* 347 (May 2, 1997), p. 42.

[10] "It is possible that China has maintained the offensive biological warfare program it is believed to have had before acceding to the BWC." Carl W. Ford, Jr., Assistant Secretary of State for Intelligence and Research, "Hearing on Reducing the Threat of Chemical and Biological Weapons Before the Senate Committee on Foreign Relations," (Washington, DC), March 19, 2002.

In testimony before the U.S. Congress in 2006, US officials expressed concern over China's commitment to the nonproliferation of biological weapons. Assistant Secretary of State for Verification, Compliance, and Implementation Paula DeSutter stated, "We maintain reservations about China's current research activities and dual-use capabilities, which raise the possibility that sophisticated BW and CW work could be underway. […] We also continue to believe that China maintains some elements of an offensive BW capability in violation of its BWC obligations." US Congress, U.S.-China Economic and Security Review Commission, "China's Proliferation to North Korea and Iran, and Its Role in Addressing the Nuclear and Missile Situation in Both Nations," 109th Cong., 2nd sess., September 14, 2006, p. 10.
The U.S. Department of State reported in 2005, "The United States reaffirms its judgment that China maintains some elements of an offensive BW capability in violation of its BWC obligations. Despite China's BWC CBM declarations to the contrary, indications suggest that China maintained an offensive BW program prior to acceding to the Convention in 1984." U.S. Department of State, Bureau of Verification and Compliance, *Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments*, Washington, DC, August 30, 2005, (http://www.state.gov/t/vc/rls/rpt/51977.htm).
The DOD states that it is likely China possesses infrastructure adequate to develop and produce biological warfare agents. China has reaffirmed its commitment not to develop biological weapons, but China likely retains some elements of an offensive program. China has acceded to the BWC. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 14.

[11] The following are as cited in a chart in Gordon M. Burck and Charles C. Flowerree, *International Handbook on Chemical Weapons Proliferation*, (New York, NY: Greenwood Press, 1991), pp. 168-171.
Thom Shanker, "West underwrites Third World's chemical arms," *Chicago Tribune*, 3 Apr. 1989, pp.1,6; and "Lack of candor blocks chemical arms treaty," 4 Apr. 1989, pp. 1,6 (source given as U.S. government official). Shanker identifies Cuba as probably having chemical weapons.
Harvey J. McGeorge, "Chemical addiction," *Defense & Foreign Affairs*, Apr. 1989, pp. 16-19, 32-33. McGeorge lists Cuba as a possible chemical possessor.
Senator John S. McCain, "Proliferation in the 1990s: implications for U.S. policy and force planning," Table 1, *Congressional Record*, 2 Nov. 1989, p. S14605; "Estimates are based on a variety of sources, including unclassified testimony by CIA Director William H. Webster, Seth Carus, David Goldberg, Elisa D. Harris and others and do not reflect the estimates of the U.S. Government." The report identifies Cuba as a suspected possessor state.

([12] Avner Cohen, "Israel and Chemical/Biological Weapons: History, Deterrence, and Arms Control," *The Nonproliferation Review*, Vol. 8, No. 3 (Fall-Winter), pp. 41-42.
Rear Admiral Thomas Brooks identified Egypt as a "probable" chemical weapons possessor in testimony before Congress. Brooks, statement before the Subcommittee on Seapower, Strategic and Critical Materials, 1991, p. 107.
Anthony Cordesman, "The Proliferation of Weapons of Mass Destruction in the Middle East: The Impact on the Regional Military Balance," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p43.
See also: Dany Shoham, "Chemical and Biological Weapons in Egypt," *The Nonproliferation Review*, 5 (Spring-Summer 1998), pp. 48-58. For further information on Egypt's weapons of mass destruction programs and capabilities, see the CNS country profile on the "Weapons of Mass Destruction in the Middle East" web page at (http://cns.miis.edu/research/wmdme/egypt.htm).

([13] Egypt likely possesses sarin, VX, mustard, and phosgene. Shoham, "Chemical and Biological Weapons in Egypt," p. 49.
Russian intelligence reports that Egypt has assimilated "techniques for the production of nerve and blister agents." Russian Federation Foreign Intelligence Service, "A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction," in *Proliferation Threats of the*

1990's, Hearing Before the Committee on Governmental Affairs, United States Senate, 103[rd] Congress, First Session, February 24, 1993, (Washington, DC: Government Printing Office, 1993), p. 92.
[14] "The United States believes that Egypt had developed biological warfare agents by 1972. There is no evidence to indicate that Egypt has eliminated this capability and it remains likely that the Egyptian capability to conduct biological warfare continues to exist." Arms Control and Disarmament Agency, *Adherence to and Compliance with Arms Control Agreements: 1998 Annual Report to Congress*, (http://www.state.gov/www/global/arms/reports/annual/comp98.html).

A Russian intelligence report cites Egypt as having "a program of military-applied research in the area of biological weapons." It also states that there is no evidence that weapons for military use have been developed. Russian Federation Foreign Intelligence Service, *A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction,* p. 93.
"Egypt appears to have developed several natural pathogens and toxins as warfare agents and has recently taken the first steps to acquire a capability for the genetic engineering of microbial pathogens." Shoham, "Chemical and Biological Weapons in Egypt," p. 56.
Cordesman cites Egypt as having the capability to conduct biological weapons research. Anthony Cordesman, "The Proliferation of Weapons of Mass Destruction in the Middle East: The Impact on the Regional Military Balance," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p43.

[15] Shoham, in "Chemical and Biological Weapons in Egypt," writes that Egypt has conducted research on anthrax, botulinum toxin, plague, cholera, tularemia, glanders, brucellosis, meliodosis, Japanese B. encephalitis, Eastern equine encephalitis, influenza, smallpox and mycotoxins. This list has been disputed and there is no other open source information available to verify the agents listed in the Shoham article.

[16] Rear Admiral Thomas Brooks identified Ethiopia as a "probable" chemical weapons possessor in testimony before Congress. Brooks, statement before the Subcommittee on Seapower, Strategic and Critical Materials, p. 107.

[17] In a 1988 speech to the United Nations, French President, Mitterrand, claimed that France had no chemical weapons, and would produce none. Victor A. Utgoff, *The Challenge of Chemical Weapons: An American Perspective*, (New York, NY: St. Martin's Press, 1991), pp. 123-124.
An article in *The Economist* suggests that France might "have destroyed [its] chemical weapons before signing the CWC." "Chemical Weapons. Just Checking," *The Economist*, p. 42.

[18] At the start of World War II, the French had a stockpile of mustard gas and phosgene. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume I: The Rise of CB Weapons*, p. 117.
Testing of chemical weapons occured at a site called B2-Namous in Algeria. Vincent Jauvert, "Quand la France Teste des armes chimiques en Algerie," *Le Nouvel Observateur*, (Oct. 23-29, 1997), pp. 10-22.

[19] Olivier Lepick, "French activities related to biological warfare, 1919-45," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), p. 70.

[20] Olivier Lepick, "French activities related to biological warfare, 1919-45," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), pp. 78, 82- 90.

[21] Following World War II, "West Germany unilaterally renounced the manufacture of nuclear, biological and chemical weapons." With the signing of the revised Brussels Treaty in

1954 and the establishment of the Western European Union, West Germany's pledge not to manufacture NBC weapons became an international commitment subject to verification. Utgoff, *The Challenge of Chemical Weapons: An American Perspective*, pp. 90-91.
[22] Germany's World War II stockpile of chemical weapons included phosgene, cyanide, mustard gas, sarin, and tabun. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume II: CB Weapons Today*, p. 127.
The Germans also reportedly produced soman. Bryden, *Deadly Allies: Canada's Secret War 1937-1947*, p. 181.

[23] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
Mark Wheelis, "Biological sabotage in World War I," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), p. 35.
Erhard Geissler, "Biological warfare activities in Germany, 1923-45," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), p. 91.
Germany's World War II biological weapons program was not institutionalized until the establishment of a research station at Posen in 1943. As Soviet forces moved toward the Posen facility in March 1945, work at the station ended--"without having accomplished anything very startling." Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume I: The Rise of CB Weapons*, p. 117.

[24] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
Erhard Geissler, "Biological warfare activities in Germany, 1923-45," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), pp. 106, 117, 120-121.
Plague, cholera, typhus, and yellow fever were among the agents studied by Germany's biological weapons program. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume I: The Rise of CB Weapons*, p. 117.
Anthrax and glanders were used offensively by Germany during World War I in a veterinary sabotage programe. Mark Wheelis, "Biological sabotage in World War I," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), p. 40-57.

[25] India Acknowledged its chemical warfare program in 1997 and stated that related facilities would be open for inspection. India has a sizable chemical industry which could be source of dual-use chemicals for countries of proliferation concern. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 24. India has declared Category 1, 2, and 3 chemical weapons to the OPCW.

[26] India has substantial biotechnical infrastructure and expertise, some of which is being used for biological warfare defense research. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 24.

[27]"Iran is a party to the Chemical Weapons Convention (CWC). Nevertheless, during the reporting period it continued to seek production technology, training, and expertise from Chinese entities that could further Tehran's efforts to achieve an indigenous capability to produce nerve agents. Iran likely has already stockpiled blister, blood, choking, and probably nerve agents—and the bombs and artillery shells to deliver them—which it previously had manufactured." Central Intelligence Agency, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January Through 30

June 2003," (Washington, DC: U.S. Central Intelligence Agency, 2003), (https://www.cia.gov/library/reports/archived-reports-1/jan_jun2003.htm#iran).
Anthony Cordesman, "The Proliferation of Weapons of Mass Destruction in the Middle East: The Impact on the Regional Military Balance," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p70.
Russian Federation Foreign Intelligence Service, *A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction*, 1993, p. 98.
"The United States judges that Iran is in violation of its CWC obligations because Iran is acting to retain and modernize key elements of its CW infrastructure to include an offensive CW R&D capability and dispersed mobilization facilities." U.S. Department of State, Bureau of Verification and Compliance, *Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments*, Washington, DC, August 30, 2005, (http://www.state.gov/t/vc/rls/rpt/51977.htm).
"In the past Tehran has manufactured and stockpiled blister, blood and choking chemical agents, and weaponized some of these agents into artillery shells, mortars, rockets, and aerial bombs. It is also believed to be conducting research on nerve agents." U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 36.
For further information on Iran's weapons of mass destruction programs and capabilities, see the CNS country profile on the "Weapons of Mass Destruction in the Middle East" web page at (http://cns.miis.edu/research/wmdme/iran.htm).

[28] Anthony Cordesman, "The Proliferation of Weapons of Mass Destruction in the Middle East: The Impact on the Regional Military Balance," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p70.

[29] "Even though Iran is part of the *Biological Weapons Convention* (BWC), Tehran probably maintained an offensive BW program. Iran continued to seek dual-use biotechnical materials, equipment, and expertise. While such materials had legitimate uses, Iran's biological warfare (BW) program also could have benefited from them. It is likely that Iran has capabilities to produce small quantities of BW agents, but has a limited ability to weaponize them." Central Intelligence Agency, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January Through 30 June 2003," (Washington, DC: U.S. Central Intelligence Agency, 2003), (https://www.cia.gov/library/reports/archived-reports-1/jan_jun2003.htm#iran).
Anthony Cordesman, *Weapons of Mass Destruction in Iran: Delivery Systems, and Chemical, Biological, and Nuclear Programs*, (Center for Strategic and International Studies, April 28, 1998), (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1325/type,1/), pp. 13-14.
In a speech to the Fifth Review Conference on the *Biological Weapons Convention* in Geneva on November 19, 2001, John Bolton, the Undersecretary of State for Arms Control and International Security, accused Iran of operating a clandestine biological weapons program. Jenni Rissanen, Acrimonious Opening for BWC Review Conference, *BWC Review Conference Bulletin*, (Acronym Institute, November 19, 2001), (http://www.acronym.org.uk/bwc/revcon1.htm).
"Iran possesses overall infrastructure and expertise to support a biological warfare program. It pursues contacts with Russian entities and other sources to acquire dual-use equipment and technology and is believed to be actively pursuing offensive biological warfare capabilities. It may have small quantities of usable agent now." U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 35.
"The United States judges that, based on all available information, Iran has an offensive biological weapons program in violation of the BWC." U.S. Department of State, Bureau of Verification and Compliance, *Adherence to and Compliance with Arms Control, Nonproliferation, and Disarmament Agreements and Commitments*, Washington, DC, August 30, 2005, (http://www.state.gov/t/vc/rls/rpt/51977.htm).

[30] Anthony Cordesmann, *Weapons of Mass Destruction in Iran: Delivery Systems, and Chemical, Biological, and Nuclear Programs*, (Center for Strategic and International Studies,

April 28, 1998), (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1325/type,1/), p15.

[31] Following Operation Iraqi Freedom, the Iraq Study Group, led by Charles Duelfer, concluded that "Iraq unilaterally destroyed its undeclared chemical weapons stockpile in 1991," but "Saddam [Hussein] never abandoned his intentions to resume a CW effort when sanctions were lifted and conditions were judged favorable." "Iraq's Chemical Warfare Program," *Comprehensive Report of the Special Advisor to the DCI on Iraq's WMD*, Volume 3, p1, (https://www.cia.gov/library/reports/general-reports-1/iraq_wmd_2004/index.html). For further information on Iraq's former weapons of mass destruction programs and capabilities, see the CNS country profile on the "Weapons of Mass Destruction in the Middle East" web page at (http://cns.miis.edu/research/wmdme/iraq.htm) and CNS's "Special Collection on the Iraq Crisis" web page at (http://cns.miis.edu/research/iraq/index.htm).

[32] For more information on Iraq's CW activities, see: Anthony Cordesman, "Weapons of Mass Destruction in Iran and Iraq," Background Paper for Testimony to the Senate Foreign Relations Committee, (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1245/type,1/).
In the past Iraq produced mustard gas, sarin, tabun, and VX. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p 50.
"Agent-15 belongs to the glycollates, a large group of chemicals which also includes the chemical warfare agent BZ. The chemicals block cholinergic nerve transmission in the central and peripheral nervous system...little information is publicly known about Agent-15, except that it is closely related to BZ. The understanding of its physiological effects is based on studies with the latter agent." Stockholm International Peace Research Institute, Agent - 15, (http://www.sipri.org/contents/cbwarfare/cbw_research_doc/cw_doc/Agent-15.html).

[33] Following Operation Iraqi Freedom, the Iraq Study Group, led by Charles Duelfer, concluded that Iraq had abandoned its BW program in the mid-1990s. However, Saddam Hussein retained the requisite technology to reinitiate a BW program on relatively short notice, although no evidence was found to suggest this was considered after 1996. "Biological Warfare," *Comprehensive Report of the Special Advisor to the DCI on Iraq's WMD*, Volume 3, p1, (https://www.cia.gov/library/reports/general-reports-1/iraq_wmd_2004/index.html). For further information on Iraq's former weapons of mass destruction programs and capabilities, see the CNS country profile on the "Weapons of Mass Destruction in the Middle East" web page at (http://cns.miis.edu/research/wmdme/iraq.htm) and CNS's "Special Collection on the Iraq Crisis" web page at (http://cns.miis.edu/research/iraq/index.htm).

[34] For more information on Iraq's BW activities, see: U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), pp. 39-40.
Jenni Rissanen, "Acrimonious Opening for BWC Review Conference," *BWC Review Conference Bulletin*, (Acronym Institute, November 19, 2001), (http://www.acronym.org.uk/bwc/revcon1.htm).
Anthony Cordesman, "Weapons of Mass Destruction in Iran and Iraq," Background Paper for Testimony to the Senate Foreign Relations Committee, 2000, (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1245/type,1/).
Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
United Nations, United Nations Special Commission (UNSCOM), "Fourth Report under Resolution 1051" (June 10, 1997), (http://www.un.org/Depts/unscom/unscmdoc.htm).
According to ACDA, Iraq produced anthrax, botulinum toxin, aflatoxin, ricin, wheat cover smut, and researched Clostridium perfringens (gas gangrene), hemorrhagic conjuctivitis virus, rotavirus, and camel pox. *Arms Control and Disarmament Agency, Adherence to and Compliance with Arms Control Agreements: 1995 Annual Report to Congress*, (http://dosfan.lib.uic.edu/acda/reports/complian.htm)

[35] Avner Cohen, "Israel and Chemical/Biological Weapons: History, Deterrence, and Arms Control," *The Nonproliferation Review*, Vol. 8, No. 3 (Fall-Winter), pp. 27-53.
"Israel may have the contingency capability to produce at least two types of chemical weapons and has certainly studied biological weapons as well as chemical ones. According to one interview with an Israeli source of unknown reliability, Israel has mustard gas, persistent and

non-persistent nerve gas, and may have at least one additional agent." Anthony Cordesman, "The Proliferation of Weapons of Mass Destruction in the Middle East: The Impact on the Regional Military Balance," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p48.
The *London Sunday Times* reports that Israeli F-16 fighters have been equipped to carry chemical weapons and that their crews have been trained on the use of such weapons. Uzi Mahnaimi, "Israeli Jets Equipped For Chemical Warfare," *London Sunday Times*, October 4, 1998.
"Israel has a store of chemical weapons of its own manufacture...Israel is capable of producing toxic substances of all types, including nerve-paralyzing, blister-producing and temporarily incapacitating substances and so forth. The country has for this a highly developed chemical and petrochemical industry and skilled specialists and also stocks of source material." Russian Federation Foreign Intelligence Service, *A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction*, 1993.
In a 1974 hearing before the Senate Armed Services Committee, General Almquist stated that Israel had an offensive chemical weapons capability. Senate Armed Services Committee, FY 1975 Authorization Hearing, Part 5, March 7, 1974.
For further information on Israel's weapons of mass destruction programs and capabilities, see the CNS country profile on the "Weapons of Mass Destruction in the Middle East" web page at (http://cns.miis.edu/research/wmdme/israel.htm).

[36] Avner Cohen, "Israel and Chemical/Biological Weapons: History, Deterrence, and Arms Control," *The Nonproliferation Review*, Vol. 8, No. 3 (Fall-Winter), pp. 27-53.
While it is unclear exactly what chemical agents Israel may produce, Dutch officials have identified that an El Al 747 that crashed in Amsterdam in 1992 was carrying a shipment of DMMP destined for Israel. DMMP is a nerve gas precursor used in the manufacture of sarin gas. Uzi Mahnaimi, "Israeli Jets Equipped For Chemical Warfare," *London Sunday Times*, October 4, 1998.

[37] Avner Cohen, "Israel and Chemical/Biological Weapons: History, Deterrence, and Arms Control," *The Nonproliferation Review*, Vol. 8, No. 3 (Fall-Winter), pp. 27-53.
Israel has conducted research into weapons and defense and has the ability to produce biological weapons; however, there is no indication of a production effort. Cordesman, "Creeping Proliferation Could Mean a Paradigm Shift in the Cost of War and Terrorism," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p48.

A Russian intelligence report indicates that Israel has a biological research program of a general nature "in which elements of a military-applied purpose are present." Russian Federation Foreign Intelligence Service, *A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction,* p. 94.

The *London Sunday Times* reports that Israeli F-16 fighters have been equipped to carry biological weapons and that their crews have been trained on the use of such weapons. Uzi Mahnaimi, "Israeli Jets Equipped For Chemical Warfare," *London Sunday Times*, October 4, 1998.

[38] As part of the 1947 Peace Treaty, Italy is forbidden from possessing chemical weapons, even for deterrent purposes. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume II: CB Weapons Today*, p. 187.

[39] The Italian chemical weapons inventory during World War II included mustard gas and phosgene. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume I: The Rise of CB Weapons*, p. 292.

[40] *The Economist* reports that Japan ended its chemical weapons program "years ago," placing it together with Britain, which ended its program in the 1950s. "Chemical Weapons. Just Checking," *The Economist*, p. 42.
While Japan might have ended its CW program years ago, it remains legally responsible for hundreds of thousands of chemical munitions it abandoned in China during World War II. In an

article discussing the problems involved in disposing of the weapons left behind in China, a Japanese newspaper reports that "[s]ince Japan's postwar defense forces do not have chemical weapons, there is no section in the Japanese government that is completely familiar with neutralization of chemical weapons." Masato Ishizawa, "Chemical Weapons Return to Haunt Japan: Bombs Left in China Pose Dangerous Task of Removal, Disposal," *The Nikkei Weekly*, January 20, 1997, p. 1.
Chinese officials claim that the Japanese left over two million chemical munitions in China, while Japanese officials insist the number is closer to 700,000. "Chemical weapons," *Mainichi Daily News*, July 28, 1998, p.2.
For further information on Japan's abandoned chemical weapons in China, see Hongmei Deng and Peter O'Meara Evans, "Social and Environmental Aspects of Abandoned Chemial Weapons in China," *The Nonproliferation Review*, 4, (Spring-Summer 1997), pp. 101-108.
See also: George Wehrfritz, Hideko Takayama, and Lijia MacLeod, "In Search of Buried Poison," *Newsweek* 132, (July 20, 1998).

[41] Japan's World War II stockpile of chemical weapons included phosgene, chloropicrin (a lung irritant), cyanide, mustard gas, and lewisite. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume II: CB Weapons Today*, p. 127.

[42] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
Sheldon Harris, "The Japanese biological warfare programme: an overview," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), p. 127.
Between 1937 and 1945, Japan operated a biological weapons program in occupied Manchuria. United States Army, Medical Research Institute of Infectious Diseases (USAMRIID), "Medical Defense Against Biological Warfare Agents Course: History of Biological Warfare," (http://www.au.af.mil/au/awc/awcgate/usamriid/bw-hist.htm).

[43] Sheldon Harris, "The Japanese biological warfare programme: an overview," in *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), pp. 138, 140, 142-3, 149.
[44] On December 19, 2003, Libya announced an agreement with the U.S. and the U.K. to dismantle its WMD programs and missile programs. Libya pledged to eliminate all its CW stocks and accede to the CWC. Libya acceded to the CWC on January 6, 2004. Libya declared to the OPCW that it had produced and stockpiled 23 tons of mustard. Sharon A. Squassoni and Andrew Feickert, "Disarming Libya: Weapons of Mass Destruction," *Congressional Research Service*, April 22, 2004, (http://www.fpc.state.gov/documents/organization/32007.pdf).

[45] For information on Libya's prior CW activities, see:
Anthony Cordesman, "The Proliferation of Weapons of Mass Destruction in the Middle East: The Impact on the Regional Military Balance," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p36.
The U.S Department of Defense has stated that Libya produced blister and nerve agents in the 1980's at Rabta; employed chemical agents against Chadian troops in 1987 and attempted to construct underground chemical agent production facility at Tarhunah. Both the Rabta and Tarhunah facilties are believed to be inactive, although chemical program not completely abandoned. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 46.
"Libya also remained heavily dependent on foreign suppliers for CW precursor chemicals and other key related equipment. Following the suspension of UN sanctions, Tripoli reestablished contacts with sources of expertise, parts, and precursor chemicals abroad, primarily in Western Europe. Libya has indicated—as evidenced by its observer status at the April 2003 Chemical Weapons Convention Review Conference and previous Convention Conferences of States Parties—a willingness to accede to the CWC. Such efforts are consistent with steps that Tripoli is taking

to improve its international standing. Tripoli still appeared to be working toward an offensive CW capability and eventual indigenous production. Evidence suggested that Libya also sought dual-use capabilities that could be used to develop and produce BW agents." Central Intelligence Agency, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 January Through 30 June 2003," (Washington, DC: U.S. Central Intelligence Agency, 2003), (https://www.cia.gov/library/reports/archived-reports-1/jan_jun2003.htm - 6).
For further information on Libya's former weapons of mass destruction programs and capabilities, see the CNS country profile on the "Weapons of Mass Destruction in the Middle East" web page at (http://cns.miis.edu/research/wmdme/libya.htm)

[46] On December 19, 2003, Libya announced an agreement with the U.S. and the U.K. to dismantle its WMD programs and missile programs. According to the CIA, "Libya disclosed past intentions to acquire equipment and develop capabilities related to biological warfare, but it remains unclear if these activities were offensive or defensive in nature." The U.S. has long suspected that Libya may have had a nascent biological weapons program, although to date no concrete evidence of an offensive BW program has surfaced. Central Intelligence Agency, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July Through 31 December 2003," (Washington, DC: U.S. Central Intelligence Agency, 2003), (https://www.cia.gov/library/reports/archived-reports-1/july_dec2003.htm).
In a speech to the Fifth Review Conference on the Biological Weapons Convention in Geneva on November 19, 2001, John Bolton, the Undersecretary of State for Arms Control and International Security, accused Libya of operating a clandestine biological weapons program. Jenni Rissanen, Acrimonious Opening for BWC Review Conference, *BWC Review Conference Bulletin*, (Acronym Institute, November 19, 2001), (http://www.acronym.org.uk/bwc/revcon1.htm).
"Evidence suggests Libya is seeking to acquire the capability to develop and produce BW agents. Such development or production would violate key provisions of the BWC. Libya has also failed to submit the data declarations stipulated in the CBMs. Evidence indicates that Libya has the expertise to produce small quantities of biological equipment for its BW program and that the Libyan Government is seeking to move its research program into a program of weaponized BW agents." Robert J. Einhorn, Testimony Before the Senate Foreign Relations Committee, Washington, DC, October 5, 2000, (http://www.state.gov/www/policy_remarks/2000/001005_einhorn_sfrc.html).
"There is information indicating that Libya is engaged in initial testing in the area of biological weapons." Russian Federation Foreign Intelligence Service, *A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction*, p. 100.

[47] Rear Admiral Thomas Brooks identified Myanmar as a "probable" chemical weapons possessor in testimony before Congress. Brooks, statement before the Subcommittee on Seapower, Strategic and Critical Materials, p. 107.

[48] "Pyongyang continued to acquire dual-use chemicals that could potentially be used to support Pyongyang's long-standing CW program. North Korea's CW capabilities included the ability to produce bulk quantities of nerve, blister, choking, and blood agent, using its sizable, although aging, chemical industry. North Korea may possess a stockpile of unknown size of these agents and weapons, which it could employ in a variety of delivery means." Central Intelligence Agency, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July Through 31 December 2003," (Washington, DC: U.S. Central Intelligence Agency, 2003), (https://www.cia.gov/library/reports/archived-reports-1/july_dec2003.htm).
"North Korea has a long-standing chemical weapons program. North Korea's domestic chemical industry can produce bulk quantities of nerve, blister, choking, and blood agents. We believe it has a sizeable stockpile of agents and weapons." Carl W. Ford, Jr., Assistant Secretary of State for Intelligence and Research, "Hearing on Reducing the Threat of Chemical and Biological Weapons Before the Senate Committee on Foreign Relations," (Washington, DC), March 19, 2002.

Joseph S. Bermudez, Jr., *The Deterrence Series*, "Case Study 5: North Korea," (Alexandria, VA: Chemical and Biological Arms Control Institute, 1998), p. 5.
The Department of Defense reports that North Korea's chemical warfare capabilities include the ability to produce bulk quantities of nerve, blister, choking, and blood agents, using its sizeable, although aging, chemical industry. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 11.
Rear Admiral Thomas Brooks identified North Korea as a "probable" chemical weapons possessor in testimony before Congress. Brooks, statement before the Subcommittee on Seapower, Strategic and Critical Materials, p. 107.

[49] Joseph S. Bermudez, Jr., The Deterrence Series, Case Study 5: North Korea, (Alexandria, VA: Chemical and Biological Arms Control Institute, 1998), p. 5. For more information on North Korea's weapons of mass destruction programs, see the North Korea country profile on the Nuclear Threat Initiative website, (http://nti.org/e_research/profiles/NK/index.html).

[50] "North Korea has acceded to the Biological and Toxin Weapons Convention but nonetheless has pursued BW capabilities since the 1960s. Pyongyang acquired dual-use biotechnical equipment, supplies, and reagents that could be used to support North Korea's BW program. North Korea is believed to possess a munitions production infrastructure that would have allowed it to weaponize BW agents and may have some such weapons available for use." Central Intelligence Agency, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions, 1 July Through 31 December 2003," (Washington, DC: U.S. Central Intelligence Agency, 2003), (https://www.cia.gov/library/reports/archived-reports-1/july_dec2003.htm).
Joseph S. Bermudez, Jr., *The Deterrence Series*, "Case Study 5: North Korea," p. 11-12.
In a speech to the Fifth Review Conference on the Biological Weapons Convention in Geneva on November 19, 2001, John Bolton, the Undersecretary of State for Arms Control and International Security, accused North Korea of operating a clandestine biological weapons program. Jenni Rissanen, Acrimonious Opening for BWC Review Conference, *BWC Review Conference Bulletin*, (Acronym Institute, November 19, 2001), (http://www.acronym.org.uk/bwc/revcon1.htm).
North Korea has pursued biological warfare capabilities since the 1960's. Furthermore, North Korea possesses infrastructure that can be used to produce biological warfare agents. North Korea may have biological weapons available for use. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 10.
"North Korea is performing applied military-biological research in a whole number of universities, medical institutes, and specialized research institutes. Work is being performed in these research centers with inducersof malignant anthrax, cholera, bubonic plague and smallpox. Biological weapons are being tested on the island territories belonging to the DPRK." Russian Federation Foreign Intelligence Service, *A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction*, 1993.

[51] In its 2006 Defense White Paper, the South Korean Ministry of Defense stated with respect to North Korea's chemical and biological weapons programs, "It is assessed that North Korea has been producing poison gas and biological weapons since the 1980s. It is believed that 2,500 to 5,000 tons of a variety of agents including nerve agents remain stored in a number of facilities…and that North Korea is able to produce biological weapons such as the bacteria of anthrax, smallpox, and cholera." Ministry of Defense, Republic of Korea, *2006 Defense White Paper* (English translation), May 2007, p. 74, (http://www.mnd.go.kr/mndEng/DefensePolicy/Whitepaper/index.jsp).
"The Actual Situation of North Korea's Biological and Chemical Weapons," *Foresight*, February 17, 2001, pp. 24-25, translated in FBIS.
North Korea Advisory Group, Report to the Speaker, U.S. House of Representatives, November 1999.
"Pyongyang's resources include a rudimentary (by Western standards) biotechnical infrastructure that could support the production of infectious biological warfare agents and toxins such as anthrax, cholera, and plague." U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 10.

Russian intelligence reports that North Korea is conducting military applied research on anthrax, cholera, bubonic plague and smallpox. Russian Federation Foreign Intelligence Service, *A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction*, p. 99.
For more information on North Korea's weapons of mass destruction programs, see the North Korea country profile on the Nuclear Threat Initiative website, (http://nti.org/e_research/profiles/NK/index.html).

[52] Pakistan has imported a number of dual-use chemicals that can be used to make chemical agents. U.S. Department of Defense, Proliferation: Threat and Response 2001, (http://fas.org/irp/threat/prolif00.pdf), p. 28.
Rear Admiral Thomas Brooks identified Pakistan as a "probable" chemical weapons possessor in testimony before Congress. Brooks, statement before the Subcommittee on Seapower, Strategic and Critical Materials, p. 107.
"[R]esearch of an applied military nature is being conducted" by Pakistan in the area of chemical weapons. Russian Federation Foreign Intelligence Service, A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction, p. 101.

[53] Pakistan is believed to have the resources and capabilities to support a limited biological warfare research and development effort. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 28.

[54] The Department of Defense reports that Russia has acknowledged the world's largest stockpile of chemical agents of 40,000 metric tons, and has developed a new generation of chemical agents. The DOD believes that Russia still has not divulged the full extent of their chemical agent and weapon inventory. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 57.
"Russian officials do not deny research has continued but assert that it aims to develop defenses against chemical weapons...Many of the components for new binary agents developed by the former Soviet Union are not on the CWC's schedule of chemicals and have legitimate civil applications, clouding their association with chemical weapons use." Carl W. Ford, Jr., Assistant Secretary of State for Intelligence and Research, "Hearing on Reducing the Threat of Chemical and Biological Weapons Before the Senate Committee on Foreign Relations," (Washington, DC), March 19, 2002.

[55] Clifford Krauss, "U.S. Urges Russia To End Production of Nerve Gas," *New York Times*, February 6, 1997.
Frank Von Hippel, "Russian whistleblower faces jail," *The Bulletin of Atomic Scientists*, 49, (March, 1993).
Russia's chemical weapons program has reportedly developed a new class of advanced binary chemical weapons, referred to as the Novichok series. A-232 is both a unitary agent and a Novichok precursor. Dr. Vil S. Mirzayanov, "Dismantling the Soviet/Russian Chemical Weapons Complex: An Insider's View," *Chemical Weapons Disarmament in Russia: Problems and Prospects*, (Washington, DC: The Henry L. Stimson Center, 1995), pp. 24-25.

[56] "The United States continues to assess that Russia maintains a mature offensive BW program and that its nature and status have not changed. Russia's BW program builds on capabilities and expertise inherited from the far more extensive Soviet BW program that dates back to the 1920s. Since the Soviet era, elements of that former Soviet BW program have been subject to varying degrees of downsizing and restructuring. There have also been severe cuts in funding and personnel at some key BW facilities. However, some key components of the former Soviet program may remain largely intact and may support a mobilization capability for the production of biological agents and delivery systems." U.S. Department of State, "Adherence to and Compliance With Arms Control, Nonproliferation, and Disarmament Agreements and Commitments," August 2005, (http://www.state.gov/t/vci/rls/rpt/51977.htm).
"Key components of the former Soviet program remain largely intact and may support a possible future mobilization capability for the production of biological agents and delivery systems. Moreover, work outside the scope of legitimate biological defense activity may be

occurring now at selected facilities within Russia." Carl W. Ford, Jr., Assistant Secretary of State for Intelligence and Research, "Hearing on Reducing the Threat of Chemical and Biological Weapons Before the Senate Committee on Foreign Relations," (Washington, DC), March 19, 2002.
Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
The Department of Defense reports that some elements of large FSU biological warfare program may remain intact and could support future agent production, and that some offensive biological warfare activities may be ongoing (p. 54), with the United States continuing to receive unconfirmed reports of offensive biological warfare efforts (p. 57). U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf).

[57] The Department of Defense reports that Russia has acknowledged the world's largest stockpile of chemical agents of 40,000 metric tons, and has developed a new generation of chemical agents. The DOD believes that Russia still has not divulged the full extent of their chemical agent and weapon inventory. U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 57.

[58] Nuclear Threat Initiative, "Russia: Chemical Overview," (http://nti.org/e_research/profiles/Russia/Chemical/index.html).

[59] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.

[60] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
"According to its declaration, Russia maintained an offensive research and development program until March 1992 that worked with anthrax, tularemia, brucellosis, plague, Venezuelan equine encephalitis, typhus, and Q-fever. With respect to toxins, Russia claimed that the only natural toxin studied in its program was botulinum toxin." Richard Boucher, U.S. Department of State, "Joint US/UK/Russian Statement on Biological Weapons," Press Release, Office of Public Affairs (Washington, DC: U.S. Department of State, September 14, 1992), cited in Graham S. Pearson, "The Threat of Deliberate Disease in the 21st Century," *Biological Weapons Proliferation: Reasons for Concern, Courses of Action*, (Washington, DC: The Henry L. Stimson Center, January 1998), p. 29.

Russian defector Kanatjan Alibekov (Kenneth Alibek), a former deputy director of the Soviet/Russian biological warfare development program, lists the following agents as either weaponized or researched by the Soviet/Russian program: smallpox, plague, anthrax, Venezuelan equine encephalomyelitis, glanders, brucellosis, Marburg virus, Ebola virus, Argentinian hemorrhagic fever, Machupo virus, yellow fever, Lassa fever, Japanese encephalitis, Russian spring-summer encephalitis, tularemia, typhus, Q-fever, psittacosis, ornithosis, rinderpest virus, African swine fever virus, wheat stem rust, and rice blast. Dr. Kenneth Alibek, statement before the Joint Economic Committee, U.S. Congress, Joint Economic Committee, "Terrorism and Intelligence Operations: Hearing before the Joint Economic Committee," 105[th] Congress, Second Session, May 20, 1998, (http://www.house.gov/jec/hearings/intell/alibek.htm)

[61] Lynne Duke, "Doubts Arise on Junking of Chemical Arms; S. African Panel Told Some Drugs, Formulas May Have Been Secretly Held Back," *Washington Post*, July 9, 1998, A24. A government spokesman stated that South Africa's chemical weapons program has been "terminated, and that the material for offensive purposes in government storage has been destroyed." The program was shut down in 1993 and its products dumped at sea. Buchizya Mseteka, "S. Africa Says it Terminated Chemical Weapons Scheme," *Reuters*, June 15, 1998.
[62] Stephen Burgess and Helen Purkitt, *The Rollback of South Africa's Biological Warfare Program*, INSS Occasional Paper 37, (USAF Institute for National Security Studies, February, 2001), (http://www.usafa.af.mil/inss/ocp37.htm).
David Beresford, "Mandela on apartheid's poison list," *The Age*, June 11, 1998, (http://www.theage.com.au/daily/980611/news/news18.html).

Chris Opperman, "Prosecutors Ecstatic as Basson's Buddy Talks," *Weekly Mail and Guardian* (Johannesburg), June 27, 1997.
"SADF 'made Ecstasy for riot control,'" *Business Day*, June 10, 1998.
Lynne Duke, "Doubts Arise on Junking of Chemical Arms; S. African Panel Told Some Drugs, Formulas May Have Been Secretly Held Back," *Washington Post*, July 9, 1998, A24.
"Apartheid-Era Scientist: Mandela was Target for Poisoning," *Edmonton Journal Extra*, June 10, 1998.
David Beresford, "Apartheid's Lab Rats," *Weekly Mail and Guardian* (Johannesburg), June 12, 1998.
Andrew Maykuth, "Mandela's Government Becomes Ally of Ex-Foe," *Philadelphia Inquirer*, June 20, 1998.

[63] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
Stephen Burgess and Helen Purkitt, "The Rollback of South Africa's Biological Warfare Program," INSS Occasional Paper 37, (USAF Institute for National Security Studies, February, 2001), (http://www.usafa.af.mil/inss/ocp37.htm).
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[64] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
Stephen Burgess and Helen Purkitt, "The Rollback of South Africa's Biological Warfare Program," INSS Occasional Paper 37, (USAF Institute for National Security Studies, February, 2001), (http://www.usafa.af.mil/df/inss/OCP/ocp37.pdf).

[65] Rear Admiral Thomas Brooks identified South Korea as a "probable" chemical weapons possessor in testimony before Congress. Brooks, statement before the Subcommittee on Seapower, Strategic and Critical Materials, p. 107.
Citing U.S. government sources, a 1997 article in the *Bulletin of Atomic Scientists* counts South Korea among those states suspected of having chemical weapons. E.J. Hogendoorn, "A Chemical Weapons Atlas," p. 38.
The Economist reports that South Korea is among those countries that, under the Chemical Weapons Convention, have declared possessing chemical weapons. "Chemical Weapons. Just Checking," *The Economist*, p. 42.
See footnote #13. Shanker, "West underwrites Third World's chemical arms"; McCain, "Proliferation in the 1990s: implications for U.S. Policy and force planning," in Burck and Flowerree, *International Handbook on Chemical Weapons Proliferation*, pp. 168-171. Also cited in Burck and Flowerree chart: Elisa Harris, "Chemical weapons proliferation: current capabilities and prospects for control," *New Threats: Responding to the Proliferation of Nuclear, Chemical, and Delivery Capabilities in the Third World*, (Landham, Md: Aspen Strategy Group, 1990), pp.70-72. Harris classifies South Korea as "seeking to acquire CW weapons or a production capability, or as suspected of possessing CW weapons."

[66] There is considerable uncertainty as to Sudan's chemical weapons status. For a well documented discussion of the debate please refer to the CNS Fact Sheet on Sudan, "Weapons of Mass Destruction Capabilities and Programs," (http://cns.miis.edu/research/wmdme/sudan.htm).

[67] In a speech to the Fifth Review Conference on the Biological Weapons Convention in Geneva on November 19, 2001, John Bolton, the Undersecretary of State for Arms Control and International Security, accused Sudan of operating a clandestine biological weapons program. Jenni Rissanen, *Acrimonious Opening for BWC Review Conference,* BWC Review Conference Bulletin, (Acronym Institute, November 19, 2001), (http://http://www.acronym.org.uk/bwc/revcon1.htm).

[68] "Syria has a long-standing chemical warfare program, first developed in the 1970s...it has a stockpile of the nerve agent sarin and may be trying to develop advanced nerve agents as well." Carl W. Ford, Jr., Assistant Secretary of State for Intelligence and Research, "Hearing on Reducing the Threat of Chemical and Biological Weapons Before the Senate Committee on Foreign Relations," (Washington, DC), March 19, 2002.
The DOD reports that Syria "already has a stockpile of the nerve agent sarin that can be delivered by aircraft or ballistic missiles. Additionally, Syria is trying to develop the more toxic and persistant nerve agent VX. In the future, Syria can be expected to continue to imporove its chemical agent production and storage infrastructure." U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 43.
Anthony Cordesman, "The Proliferation of Weapons of Mass Destruction in the Middle East: The Impact on the Regional Military Balance," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p56.
See also
M. Zuhair Diab, "Syria's Chemical and Biological Weapons: Assessing Capabilities and Motivations," *The Nonproliferation Review*, 5, (Fall, 1997), pp. 104-111.
For further information on Syria's weapons of mass destruction programs and capabilities, see the CNS country profile on the "Weapons of Mass Destruction in the Middle East" web page at (http://cns.miis.edu/research/wmdme/syria.htm).

[69] CDISS reports that Syria's chemical arsenal contains mustard gas, sarin, and VX. "Devil's Brews Briefing: Syria," Centre for Defence and International Security Studies, Lancaster University, 1996. The CIA reports that Syria has a stockpile of sarin. CIA, "Unclassified Report to Congress on the Acquisition of Technology Relating to Weapons of Mass Destruction and Advanced Conventional Munitions," 1 January through 30 June 2003, (https://www.cia.gov/library/reports/archived-reports-1/jan_jun2003.htm - 7).

[70] "Syria is pursuing biological weapons. It has an adequate biotechnical infrastructure to support a small biological warfare program. Without significant foreign assistance, it is unlikely that Syria could advance to the manufacture of significant amounts of biological weapons for several years." Carl W. Ford, Jr., Assistant Secretary of State for Intelligence and Research, "Hearing on Reducing the Threat of Chemical and Biological Weapons Before the Senate Committee on Foreign Relations," (Washington, DC), March 19, 2002.
In a speech to the Fifth Review Conference on the *Biological Weapons Convention* in Geneva on November 19, 2001, John Bolton, the Undersecretary of State for Arms Control and International Security, accused Syria of operating a clandestine biological weapons program. Jenni Rissanen, Acrimonious Opening for BWC Review Conference, *BWC Review Conference Bulletin*, (Acronym Institute, November 19, 2001), (http://www.acronym.org.uk/bwc/revcon1.htm).
Testifying before Congress in 1991, Rear Admiral Thomas Brooks indicated that Syria had "developed an offensive BW capability." Brooks, statement before the Subcommittee on Seapower, Strategic and Critical Materials, p. 107.
"Syria's biotechnical infrastructure is capable of supporting limited agent development. However, the Syrians are not believed to have begun any major effort to put biological agents into weapons. Without significant foreign assistance, it is unlikely that Syria could manufacture significant amounts of biological weapons for several years." U.S. Department of Defense, *Proliferation: Threat and Response 2001*, (http://fas.org/irp/threat/prolif00.pdf), p. 43.
In its annual report to Congress, ACDA states that "it is highly probable that Syria is developing an offensive biological warfare capability." Arms Control and Disarmament Agency, Adherence to and Compliance with Arms Control Agreements: 1997 Annual Report to Congress, (http://www.state.gov/www/global/arms/reports/annual/comp97.html).

[71] Anthony Cordesman, "The Proliferation of Weapons of Mass Destruction in the Middle East: The Impact on the Regional Military Balance," (http://www.csis.org/component/option,com_csis_pubs/task,view/id,1441/type,1/), March 25, 2005, p56.

[72] Rear Admiral Thomas Brooks identified Taiwan as a "probable" chemical weapons possessor in testimony before Congress. Brooks, statement before the Subcommittee on Seapower, Strategic and Critical Materials, p. 107.

[73] According to a Russian intelligence report, "Taiwan does not have biological weapons...[however], it has shown signs of conducting biological research of an applied military nature." Russian Federation Foreign Intelligence Service, *A New Challenge After the Cold War: Proliferation of Weapons of Mass Destruction*, p. 104.
ACDA reports that Taiwan has been upgrading its biotechnology capabilities, but states that the "evidence indicating a BW program is not sufficient to determine if Taiwan is engaged in activities prohibited by the BWC." Arms Control and Disarmament Agency, "Adherence to and Compliance with Arms Control Agreements: 1997 Annual Report to Congress," (http://www.state.gov/www/global/arms/reports/annual/comp97.html).

[74] The United Kingdom renounced its chemical weapons option in 1957 and subsequently destroyed its CW capabilities. Edward M. Spiers, *Chemical and Biological Weapons: A Study of Proliferation*, (New York, NY: St. Martin's Press, 1994) pp. 11, 162.
"Britain decided against building her own nerve-gas factory in the mid-1950s and, having taken that decision, discarded her residual World War II chemical weapons and closed down her chemical weapons research and development program." Julian Perry Robinson, "Appendix C: United States and NATO Chemical Weapons," in *Chemical Weapons and Chemical Arms Control*, Matthew Meselson, ed., (New York, NY: Carnegie Endowment for International Peace, 1978) p. 113.

[75] The United Kingdom's World War II stockpile of chemical weapons included phosgene, mustard gas, and lewisite. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume II: CB Weapons Today*, p. 127.

[76] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
Gradon B. Carter and Graham Pearson, "British biological warfare and biological defence, 1925-45, in Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), p. 168.
The Office of Technology Assessment includes the United Kingdom in a list of countries that have admitted to having had "offensive [biological] weapon munition supplies or development programs in the past." U.S. Congress, Office of Technology Assessment, *Proliferation of Weapons of Mass Destruction*, p. 63.

[77] Gradon B. Carter and Graham Pearson, "British biological warfare and biological defence, 1925-45, *Biological and Toxin Weapons: Research, Development and Use from the Middle Ages to 1945*, Erhard Geissler and John Ellis van Courtland Mood, eds., (New York: NY: Stockholm International Peace Research Institute, 1999), pp. 182-4.
The British biological weapons program involved research on anthrax. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume I: The Rise of CB Weapons*, p. 118.

[78] The United States stopped production of unitary chemical munitions in 1969. "Chemical and Biological Warfare," *The Military Balance 1988-1989*, (London, UK: IISS, 1988), p. 244.
In November 1985, Congress passed legislation calling for the destruction of 90 percent of the total U.S. stockpile of unitary chemical agents. On May 13, 1991, the Bush administration announced that U.S. stockpiles of both binary and unitary weapons would be detroyed when the CWC entered into force.
Amy E. Smithson, *The U.S. Chemical Weapons Destruction Program: Views, Analysis, and Recommendations*, (Washington, DC: The Henry L. Stimson Center, 1994), pp. 96, 99.

[79] Federation of American Scientists, "Chemical Weapons," (http://www.fas.org/nuke/guide/usa/cbw/cw.htm). Included in the U.S. chemical weapons stockpile are 680.19 tons of binary weapons components. Office of Assistant Secretary of Defense, U.S. Chemical Weapons Stockpile Information Declassified, (Washington, DC: Department of Defense, January 22, 1996), (http://www.defenselink.mil/releases/release.aspx?releaseid=729).

[80] Milton Leitenberg, *Biological Weapons in the Twentieth Century: A Review and Analysis*, (http://www.fas.org/bwc/papers/bw20th.htm), 2001.
"In 1969, President Nixon disestablished offensive studies including the destruction of all stockpiles of agents and munitions." Destruction of biological weapon agent stocks and munitions was accomplished between May 1971 and May 1972. The study of biological weapons continued after 1969, but for defensive purposes only. USAMRIID, "A History of Biological Warfare," (http://www.au.af.mil/au/awc/awcgate/usamriid/bw-hist.htm).

[81] National Security Archive, "National Security Decision Memoranda 35 and 44," *The September 11th Source Books: National Security Archive Online Readers on Terrorism, Intelligence and the Next War. Volume III: BIOWAR: The Nixon Administration's Decision to End U.S. Biological Warfare Programs,* (http://www.gwu.edu/~nsarchiv/NSAEBB/NSAEBB58/RNCBW22.pdf), July 6, 1970. Anthrax, brucellosis, Eastern and Western equine encephalitis, Venezuelan equine encephalomyelitis, Argentinian hemorrhagic fever, Korean hemorrhagic fever, Bolivian hemorrhagic fever, Lassa fever, tularemia, and Q-fever are among the biological agents researched by the U.S. program for offensive and/or defensive purposes. All research since 1969 has been for defensive purposes. USAMRIID, "A History of Biological Warfare," (http://www.au.af.mil/au/awc/awcgate/usamriid/bw-hist.htm). According to SIPRI, the U.S. biological program studied the following agents: anthrax, glanders, brucellosis, melioidosis, tularemia, plague, yellow fever, psittacosis, typhus, dengue fever, Rift Valley fever, Chikungunya disease virus, ricin, rice blast, rice brown spot disease, late blight of potato, stem rust of cereal, rinderpest virus, Newcastle disease virus, fowl plague virus. Stockholm International Peace Research Institute, *The Problem of Chemical and Biological Warfare, Volume I: The Rise of CB Weapons*, p. 122-123.
See also: Bryden, *Deadly Allies: Canada's Secret War 1937-1947*, (Toronto, ONT: McClelland & Stewart Inc., 1989).

[82] Rear Admiral Thomas Brooks identified Vietnam as a "probable" chemical weapons possessor in testimony before Congress. Brooks, statement before the Subcommittee on Seapower, Strategic and Critical Materials, p. 107.

[83] The Pentagon has reported the existence of chemical weapons in the FRY. Judith Miller, "U.S. Officials Suspect Deadly Chemical Weapons in Yugoslav Army Arsenal," *New York Times*, April 16, 1999.

The Federation of American Scientists has confirmed the existence of four chemical weapons facilities in the former Yugoslavia, three in Serbia and one in Bosnia. The three facilities in Serbia are Prva Iskra, in Baric, Serbia; Miloje Blagojevic in Lucani, Serbia; and Milojie Zakic and Merima in Krusevic, Serbia. The fourth facility is the Military Technical Institute in Potoci near Mostar, Bosnia and Herzegovina. The Federation of American Scientists, "Chemical Agents in the Former Yugoslavia," *Nuclear Forces Guide* , (http://www.fas.org/nuke/guide/serbia/cw/index.html), April 23, 2000.

[84] "Chemical Agents in the Former Yugoslavia," *Nuclear Forces Guide* , (http://www.fas.org/nuke/guide/serbia/cw/index.html), April 23, 2000.

Pentagon officials believe the FRY possesses sarin, mustard gas, BZ, and CS. Judith Miller, "U.S. Officials Suspect Deadly Chemical Weapons in Yugoslav Army Arsenal," *New York Times*, April 16, 1999.

Human Rights Watch reports FRY possession of sarin, sulfur mustard, BZ, CS, CN, LSD-25, chloropicrin, cyanogen chloride, soman, tabun, and VX. Human Rights Watch, "Chemical Warfare in Bosnia?," *Human Rights Watch Report*, Vol. 10, No. 9 (D), November 1998.

US and British plans to seize Syria's chemical weapons

Source: http://www.telegraph.co.uk/news/worldnews/middleeast/syria/9889961/US-and-British-plans-to-seize-Syrias-chemical-weapons.html

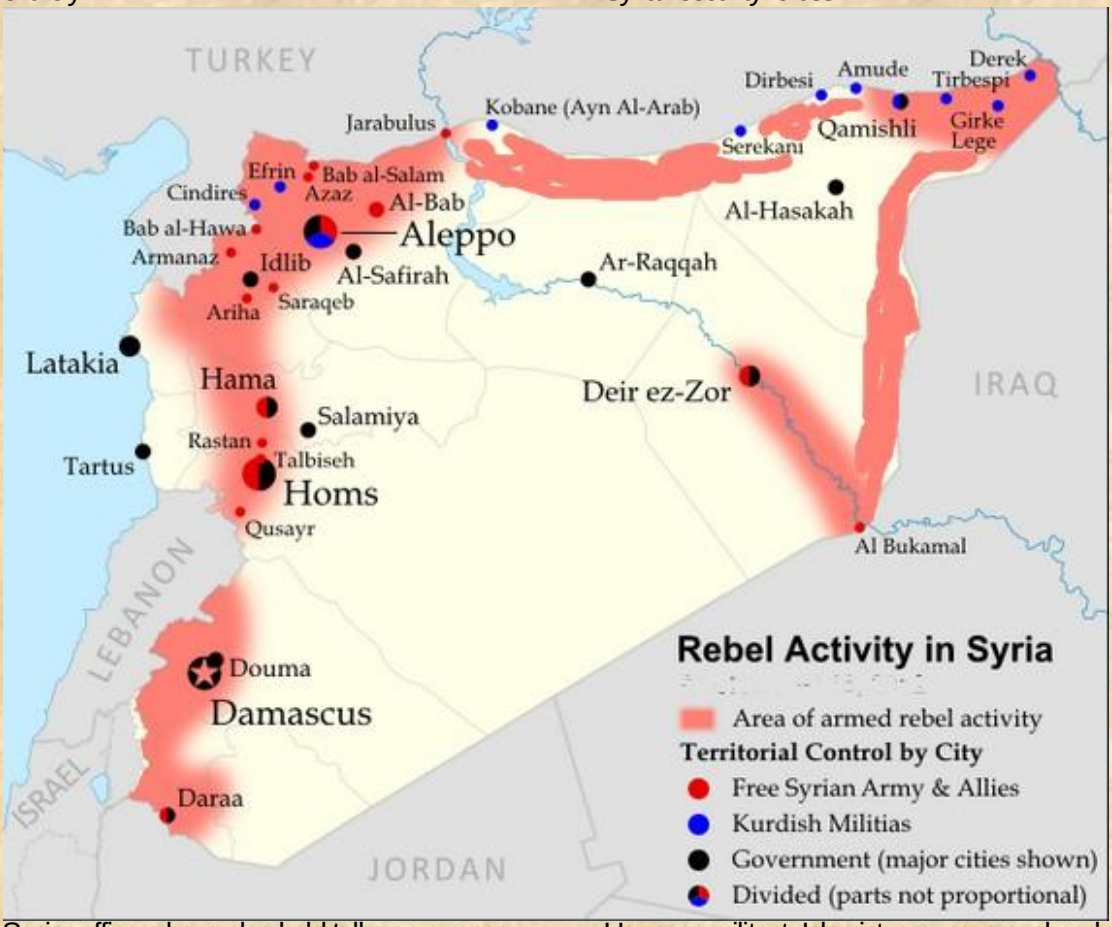
They fear that nerve agents and chemical weapons held by forces loyal to President Bashar al-Assad's regime could fall into terrorists' hands if the government collapses entirely.

Senior officers have also held talks on a range of "rogue state" contingency plans to prevent chemical, biological or nuclear weapons from being seized by terrorists, which they fear could also happen if Pakistan or North Korea's regimes were to collapse.

Iran, which according to one senior British source is "bent on developing nuclear weapons", is also causing great concern to western governments.

British intelligence believes Syria has amassed an extensive arsenal of WMD including nerve agents such as Sarin – one of the most deadly weapons ever created – and chemical weapons such as mustard gas.

They have so far not been used and are currently considered to be well guarded by the Syrian security forces.



However militant Islamist groups are already inside Syria fighting against the government and would be perfectly placed to raid WMD stockpiles, according to intelligence sources.

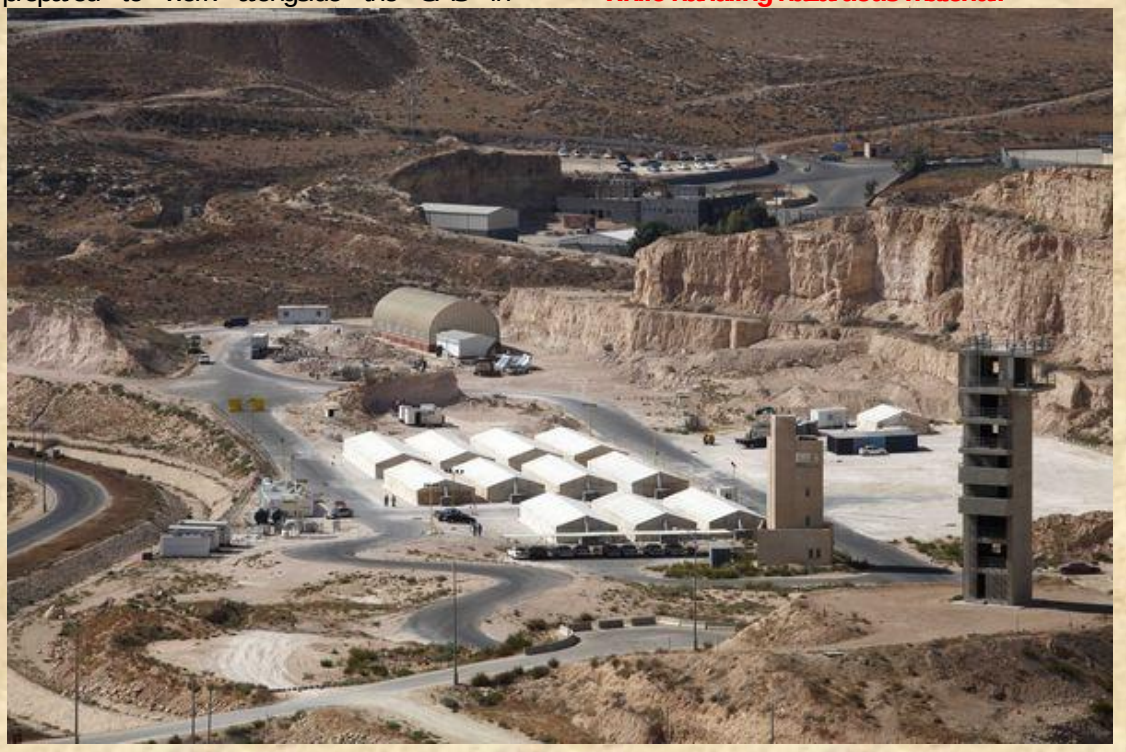
Sources have said that the most likely option to prevent WMD falling into the hands of extremists would be to destroy stockpiles in a series of air strikes.

Alternative options include the use of special forces and troops trained in chemical warfare to secure WMD sites in Syria if and when the government eventually collapses.

An RAF Regiment unit called the Defence Chemical Biological Radiological and Nuclear Wing based at Winterbourne Gunner, Wilts, has already been warned that it should be prepared to work alongside the SAS in

we can properly prepare our soldiers for this job. It's a dangerous and messy business.

"Soldiers will be driving into potentially contaminated areas, possibly under fire while handling hazardous material."



securing WMD sites in the Syria at short notice.

Last week a US-based body known as the Strategic Working Group began rehearsing how WMD stockpiles would be secured in both the Middle East and the Pacific in the event of an international emergency.

The group is composed of military personnel from the US Army, Marine Corps, Navy as well as British and Australian officers and government officials.

The senior officers tested a variety of plans at a classified war gaming session called Unified Quest 2013 at the US Army Staff College at Fort Leavenworth in Kansas.

The scenario focused on a failed state that has lost control of its WMD stockpiles, forcing the United States and other countries to intervene.

The location of the game was classified, but informed opinion suggested that North Korea was the target country.

One source who took part in the war games said: "We need to have plans in place so that

MI5, Britain's security service has repeatedly warned that it is "only a matter of time" before extremist groups carry out a "chemical, biological or radiological attack" on a western city.

Such an attack was also identified as a "Tier Two Priority Risk" in the 2010 National Security Strategy.

Defence sources said that one of the unintended consequences of the Arab Spring was the huge volume of illicit weapons which have entered the illegal arms market, increasing concerns about what could happen if Assad lost control of his WMD.

A source said: "After Libya collapsed thousands of man portable air defence weapons went missing and these can bring down an airliner.

"We know Syria has a pretty extensive armoury and a lot of chemical weapons. We need to ensure these do not enter the terrorist food chain."

Both British and US commanders agree that the West has paid "lip service" to training troops in WMD scenarios and has focused almost solely on counter-insurgency operations such as those undertaken in Afghanistan and Iraq.

One senior British source added: “Syria has a sizeable arsenal of chemical weapons including nerve agents and mustard gas.
"Pakistan and North Korea have nuclear weapons and it is widely believed that Iran also intends to develop a nuclear weapon.

“These are all unstable or unpredictable states and the potential for WMD ended up in the hands of terrorists is very real. We need contingency plans to deal with a wide variety of scenarios.”

"Sarin is pretty volatile. If all these other problems could be resolved, the sarin would probably be destroyed or would be so volatile that it would disappear quickly," Zilinskas said. "But that’s not necessarily the case with mustard gas. It’s much less deadly but much more persistent. And if the Syrians turn out to have VX, which is a persistent nerve gas, that could cause real problems. That is the worst-case scenario they have to prepare for."

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