

WORLDWIDE EMERGING ENVIRONMENTAL ISSUES AFFECTING THE U.S. MILITARY
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Note to Readers: Pages 1-10 comprise the summary and analysis of this report. Expanded details for some items that might not be available via the Internet at a later date are in the Appendix beginning on page 11.

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Item 1. Hezbollah-Israeli War Threatens an Already Precarious Environment

Arab countries are among the least environmentally sustainable in the world. The current wars are making this situation worse. The impact of the oil slick caused by Israeli bombing of the Jiyeh power station is an “environmental tragedy which is rapidly taking on a national but also a regional dimension,” warned UNEP Executive Director Achim Steiner. Long-term implications also include the loss to fishing for the Lebanese people, and decline in tourism. Presently the ecological damage spreads along 50 miles of the Lebanese coast; 10,000 tons of crude oil have been released into the Mediterranean, with another 15,000 tons expected to spill very soon. According to the Environmental Sustainability Index of Yale University, Iraq, Sudan, and Kuwait fall within the bottom 5% of the world for sustainability and half of the remaining Arab States scored in the lowest 25%. Without major changes, environmentally induced migrations and more conflicts in the region seem inevitable.

Military Implications:

Military liaisons with Arab countries should explore the possibilities of convening a regional or pan-Arab conference on environmental security. This could be an opportunity to further the Army Strategy on the Environment and communicate its value in the region. The conference might be hosted by Egypt, as part of post-conflict planning. Exploratory meetings should include those responsible for implementing the Abu Dhabi Declaration. Since 2006 is the International Year for Deserts and Desertification, military liaisons in the region might also explore how such an environmental security conference might build upon or complement plans already underway in relation to the international year.

Sources:

Environmental 'crisis' in Lebanon

<http://news.bbc.co.uk/2/hi/science/nature/5233358.stm>

UN environment agency backs response to Lebanon oil slick emergency

<http://www.un.org/apps/news/story.asp?NewsID=19351&Cr=Leban&Cr1=>

Rescue Lebanon's Coast; Oil Spill Crisis

<http://www.moe.gov.lb/rescuelebanon.htm>

Abu Dhabi Declaration on Environment and Energy

<http://www.unep.org/bh/Publications/DTIE%20Final/AbuDhabiDeclarationEn.pdf>

Environmental Sustainability Index

http://www.yale.edu/esi/ESI2005_Main_Report.pdf

"Environmental Sustainability in the Arab World"

http://www.yale.edu/envirocenter/Environmental%20Sustainability%20in%20the%20Arab%20World_Esty%20Levy%20and%20Winston.pdf

Item 2. Better International Controls Needed to Prevent Bioterrorism

“The biological weapons threat is multiplying and will do so regardless of the countermeasures we try to take,” warns Steven Block, a Stanford University biophysicist and former president of the Biophysical Society. The likelihood of SIMAD (Single Individual Massively Destructive),

motivated by ideology or personal issues, is increasing fast and there is no adequate international treaty (the Biological Weapons Convention is not enough) or oversight agency to prevent malicious use of biotechnology work. There is no monitoring of the expanding gene-synthesis industry and the supervision of controversial experiments is voluntary and irregular at universities and private laboratories around the world. While scientists are still arguing on what approach would be the best to increase protection against bioterrorism, they agree on the need for swift and intensified international control to impede the accidental or deliberate release of genetically modified organisms. Along the same lines, China has updated its 2002 list of controlled export materials that could be used to produce biological weapons to fight terrorism. The new list added 14 types of viruses, toxins, bacteria, and equipment, and strengthened export control.

Military Implications:

Relevant military and diplomatic personnel should liaise with those drafting improved international legal and enforcement frameworks to prevent bioterrorism, and then cooperate with their international counterparts for the improved control regimes.

Sources:

Custom-Built Pathogens Raise Bioterror Fears

<http://www.washingtonpost.com/wp-dyn/content/article/2006/07/30/AR2006073000580.html> (by subscription only; full text in the [Appendix](#))

The Secretive Fight Against Bioterror

<http://www.washingtonpost.com/wp-dyn/content/article/2006/07/29/AR2006072900592.html?sub=AR> (by subscription only; full text in the [Appendix](#))

A spy among us?

<http://www.baltimoresun.com/news/nationworld/bal-te.detrick30jul30,0,2573448.story>

No action on bio-terrorism loophole

<http://www.guardian.co.uk/science/story/0,,1834550,00.html?gusrc=rss&feed=18>

China to tighten biological export control

http://english.people.com.cn/200607/29/eng20060729_287991.html

Item 3. EU to Introduce New Regulations to Combat Surface Waters Pollution

The European Commission has proposed new rules regulating the amount of chemicals and toxic substances seeping into the continent's surface waters. The new regulation will apply to the 25-nation bloc, and would set new limits on the concentration levels of 41 hazardous chemicals in rivers, lakes and coastal waters. The directive, if approved by member states and the European Parliament, would require EU nations to "achieve the proposed limits for all priority substances by 2015 and cease discharges and emission of priority hazardous substances into water by 2025," says the Commission statement.

Military Implications:

The military units in the EU should follow the development of the new directive and prepare for eventual necessary changes in order to comply with the new regulations.

Sources:

Commission takes action to combat surface water pollution from dangerous substances

<http://europa.eu/rapid/pressReleasesAction.do?reference=IP/06/1007&format=HTML&aged=0&language=EN&guiLanguage=en>

Priority substances under the Water Framework Directive

http://ec.europa.eu/environment/water/water-dangersub/pri_substances.htm

Item 4. Environment to Get Crucial Role in Sudan's Future Peace and Prosperity Strategy

UNEP is conducting detailed environmental assessments in order to identify environmental impacts, pressures, risks, and priorities for Sudan's post-conflict reconstruction plans. Since December 2005, four field missions were conducted in each of the main geographic areas. These findings will be presented in the UNEP report *Sudan – Post-Conflict Environmental Assessment* scheduled for release in October 2006 and then incorporated into national policies, plans, and laws for resource management in Sudan. UNEP is also currently preparing a program entitled *Capacity Building for Environmental Governance in Sudan*, which will cover the period 2007-2009. The UNEP study and recommendations are another example of the importance being accorded to the environmental dimension in post-conflict reconstruction.

Military Implications:

Lessons learned by military and their civilian contractors from post-conflict environmental reconstruction activities should be shared with UNEP and relevant Sudanese officials, as should offers of military-to-military assistance in environmental reconstruction when more stable conditions prevail.

Source:

UN Environment at Sudan National Planning Environmental Management Workshop

<http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=483&ArticleID=5313&>

Item 5. Technological Breakthroughs with Environmental Security Implications**5.1 New and Improved Water Purification Method**

Delft University of Technology (Netherlands), with Merle de Kreuk as principal researcher, and the DHV engineering consultancy, has developed a compact and environmentally friendly water purification method, in which aerobic bacteria form granules that sink quickly. In this new aerobic granular sludge technology (Nereda™), aerobic bacterial granules are formed in the water that is to be purified. These granules not only sink quickly but their use also has the advantage that only one vessel is needed for the process. The new technique requires 25% of the space and 70% of the energy needed for earlier methods.

Military Implications:

The military should investigate the application of this method to cleanup of post-conflict environments and force protection, as well as at permanent installations.

Source:

New water-purification method promises radical improvement

<http://www.physorg.com/news70621194.html>

Item 6. Updates on Previously Identified Issues**6.1 UK Proposes Individual Carbon Trading**

The UK Minister of the Environment has proposed a plan for individual carbon-trading procedures. Under the proposal, all UK citizens would be allocated a certain annual amount of carbon credits that will be reduced each time they purchase non-renewable energy. The points will be stored on an electronic card and those who did not use their full allocation would be able to sell their surplus carbon points into a central bank, while those who run out of points will be charged additionally at the point of sale for the equivalent of the missing points. To reduce total UK emissions, the overall number of points would be reduced each year. Details and the place for launching the pilot project should be announced shortly. If the new UK carbon-trading scheme proves feasible and efficient, it is likely that it will be emulated in other (if not all) EU countries and possibly even other regions of the world strongly committed to reducing their carbon emissions. [See also *Possible Tougher European Carbon Limits* in May 2006 and other related items in previous environmental security reports.]

Military Implications:

It is not clear at this point if the points-based system will affect just individuals, or will also be extended to industry sectors including the military. If it is extended to military activities and personnel, then training for reduced carbon emissions should be explored for personnel based in the UK.

Source:

Miliband unveils carbon swipe-card plan

<http://www.guardian.co.uk/climatechange/story/0,,1824241,00.html> (article accessible free for a limited time; otherwise, subscription required; full text in the [Appendix](#))

6.2 Europe Considers Aviation Policies to Reduce Greenhouse Gases

The European Parliament is increasing its discussions on the impact of aviation on climate change, considering introducing kerosene taxes, and having the industry join the Kyoto Protocol-induced obligations. The World Travel & Tourism Council opposes such measures, which—they say—do not take into consideration the larger picture of the challenges which need to be managed, including jobs, economic impact, and even a negative effect on pollution.

Military Implications:

This issue should be monitored to see what new requirements might apply to military aviation.

Sources:

EU Parliament Wants Aviation Tax, Emissions Trade

<http://www.planetark.com/dailynewsstory.cfm/newsid/37117/story.htm>

WTTC reacts to EU aviation tax debate

<http://www.breakingtravelnews.com/article/2006071407510441>

6.3 Climate Change

6.3.1 Heat Waves and Extreme Weather Conditions Attributed Mainly to Global Warming

With extreme heat waves in Europe and the hottest summer in North America, scientists argue whether global warming is the cause; most of them agree that it is. “Ten of the last 12 years were the warmest since 1850. The global temperature (since then) rose 0.7 degrees Celsius and most climate models suggest it’s going to continue to warm by 2 to 5 degrees Celsius this century,” says Philip Jones, climate research professor at Britain’s East Anglia University. He also adds that globally, sea levels are rising by around 1.5 millimeters (0.06 inches) per year and have risen some 20 centimeters (7.8 inches) since the late 19th century. Warmer seas due to global warming will most probably also cause changes in precipitation patterns and increase intensity of hurricanes. (The IPCC’s Fourth Assessment draft text, which will be released next year, forecasts a 2–4.5° C warming by 2050—a faster change than their 2001 forecast of 1.4–5.8° C warming by 2100).

6.3.2 New Strategy of UNESCO World Heritage Committee for Heritage Sites and Climate Change

UNESCO’s World Heritage Committee is registering protected sites threatened by climate change. These sites will be monitored and actions will be suggested to prevent their damage from climate change. A policy document on the impact of climate change on World Heritage properties will be presented to the World Heritage Committee in 2007. Created in 1972, UNESCO’s World Heritage List covers 812 sites around the world. Located in 137 countries, 628 of the World Heritage sites are cultural, 160 are natural and 24 are mixed. [See also *New Protected Ecological Sites* in July 2005, *Nine New Hotspots Added to World’s Protected Areas* in February 2005, *Intensified Efforts Needed to Save Biodiversity* in January 2005, and related items on UNESCO World Heritage Sites in November and June 2004, and October 2003 environmental security monthly reports.]

6.3.3 Mission to Study Arctic Environmental Changes

The UN launched a two-year scientific mission in the Arctic to monitor changes in global climate, thinning of the ozone layer, and impacts of chemical pollution. There is evidence that the Arctic climate is warming rapidly and that more serious changes are looming, which, although with global effect, would most drastically affect indigenous communities and polar biodiversity.

6.3.4 Burning Fossil Fuels Acidifies Oceans, Erodes Coral Reefs

Impacts of Ocean Acidification on Coral Reefs and Other Marine Calcifiers, a report co-authored by scientists from Australia, Canada, France, Germany, Japan, Monaco, New Caledonia, and the United States, is a comprehensive analysis of marine calcifiers, documenting that worldwide emissions of carbon dioxide from fossil fuel burning is making the oceans more acidic, dramatically altering ocean chemistry and threatening marine biodiversity, mainly causing coral decalcification. Although recommending further research for determining the extent of the impacts, it predicts that calcification rates might decrease as much as 60% within the 21st century.

Military Implications:

[Similar to previous reports on the same issue] The military should keep up-to-date with the list of protected and/or endangered sites and plan its operations accordingly. Citing the Army’s “Strategy for the Environment,” the military should seek new opportunities to participate in dialogues among scientists, politicians, environmental NGOs, and economic decision-makers for improving biodiversity management strategies, as well as in planning its own operations. Also, Arctic missions may provide new information on global environmental changes and may be relevant to the U.S. military’s interest in the Northwest Passage. Military scenarios should also be considered to respond to disasters affecting indigenous arctic peoples.

Sources:

Climate change behind summer heat waves?

<http://msnbc.msn.com/id/13993578/>

Earth from Space: A cloudless UK

http://www.esa.int/esaEO/SEMHAZ715QE_index_0.html

World Heritage Committee adopts strategy on heritage and climate change

<http://whc.unesco.org/en/news/262>

Swiss Map Permafrost After Signs Alps Crumbling

<http://www.planetark.com/dailynewsstory.cfm/newsid/37442/story.htm>

Global Warming Puts 12 US Parks at Risk – Report

<http://www.planetark.com/dailynewsstory.cfm/newsid/37391/story.htm>

Report Warns about Carbon Dioxide Threats to Marine Life

<http://www.ucar.edu/news/releases/2006/acidification.shtml>

UN supports two-year expedition probing Arctic climate change

<http://www.un.org/apps/news/story.asp?NewsID=19156&Cr=UNEP&Cr1=>

6.4 China Creates 11 Independent Environmental “Watchdog” Centers

China is establishing eleven watchdog centers to monitor and investigate environmental issues free from local government interference. The centers will operate under direct control of the State Environmental Protection Administration (SEPA) and will include five centers for environmental supervision, and six centers to monitor nuclear and radiation security. The main role of this nationwide network is to enforce environmental laws and regulations independent of local governments. The 11 centers will be included in SEPA's 24-hour emergency response system. [See also *China's President Hu Ordered Environmental Regulations for Military Activities* in April 2006, and *Chinese Research Priorities for the Next Fifteen Years* in March 2006, and other related environmental security reports]

Military implications:

These new centers could provide early warning of environmental security changes in China.

Source:

New environment watchdogs freed from local govt meddling

http://news.xinhuanet.com/english/2006-07/31/content_4901813.htm

6.5 Nanotechnology**6.5.1 Chinese and Russian New Nanotechnology Organizations**

The Chinese Academy of Science's National Center for Nanoscience and Technology and Institute of High Energy Physics have opened a Laboratory for Biological Effects of Nanomaterials and Nanosafety in Beijing on the IHEP campus. Russia has opened the Pilot Scientific and Technical Center of Excellence for Nanotechnology Development in Moscow.

Military Implications:

Military liaisons in Russia and China should establish contact with these institutions, to exchange information on nanotechnology and related environmental security issues.

Sources:

Laboratory for Biological Effects of Nanomaterials and Nanosafety Established in China
<http://www.azonano.com/news.asp?newsID=2507>

Russia opens new nanotech center

<http://www.eetimes.com/news/semi/showArticle.jhtml?articleID=190400109>

6.5.2 UK Nanotechnology Policy Review Announced

The UK government has asked the Council for Science and Technology to review national nanotechnology policy commitments and provide written evidence of their findings. This review is in part a follow-up to the 2004 Royal Society report, *Nanoscience and nanotechnologies: opportunities and uncertainties*.

Military Implications:

Military environmental representatives in the UK should follow the progress of this effort and review the Council's report when it comes out, as its findings are very likely to have an impact on future UK internal policies and international regulatory negotiations.

Source:

UK. Nanotechnology Policy Review Announced
<http://www.bymnews.com/new/content/view/31988/82/>

6.6 Indian Ocean Tsunami Warning System Declared Operational, but Local Coordination still Lacking

At the end of June, UNESCO announced that the Indian Ocean tsunami warning system, coordinated by its Intergovernmental Oceanographic Commission, is on schedule to become operational for the entire region by the end of July. A network of 26 national information centers will allow countries to receive and distribute warnings of potential tsunamis. However, the tsunami that struck Indonesia on July 17th, caused by an earthquake off the south coast of Java, killed more than 500 people. Although the wave hit the coast 40 minutes after the quake was detected, no warning was issued to the population. [See also *Tsunami Warning and Mitigation System in the Indian Ocean* in December 2005, and other related items in previous environmental security reports.]

Military Implications:

Since the military has the capability to help in the event of another major tsunami, it should have some appropriate connection with the central warning system and eventually—until local connections are better established—try to help coordinate local warning and evacuation situations.

Sources:

Indian Ocean Tsunami Warning System up and running

http://portal.unesco.org/en/ev.php-URL_ID=33442&URL_DO=DO_TOPIC&URL_SECTION=201.html

UN-backed tsunami early warning system set to become operation in Indian Ocean

<http://www.un.org/apps/news/story.asp?NewsID=19030&Cr=tsunami&Cr1=>

Latest tsunami shows need for complete warning system: UN regional group

<http://www.un.org/apps/news/story.asp?NewsID=19286&Cr=tsunami&Cr1=>

6.7 The Debate over Use of Sonar by the Navy Continues; Legal Settlement Approved

After a temporary restraining order issued July 3, blocking the use of high-intensity, mid-frequency sonar by the U.S. Navy during international Rim of the Pacific (RIMPAC) war games taking place in waters around Hawaii, on July 7, the judge has approved a settlement between the Navy and conservation groups, permitting the use of mid-frequency sonar during the eight-nation military exercises. The settlement agreement requires new safeguards, including a buffer zone, increased monitoring for marine mammals through underwater detection and aerial surveillance for marine mammals during sonar drills and the reporting of sightings to a marine mammal response officer. This type of sonar has been associated with mass strandings and deaths of whales, dolphins, and other marine species in U.S. waters and around the world. The conservation groups that filed the lawsuit were: Natural Resources Defense Council, the International Fund for Animal Welfare, the Cetacean Society International, the Ocean Futures Society (OFS), and (OFS) founder and director Jean-Michel Cousteau. [See also *Underwater Sounds from Human Sources Endangering Marine Life* in November 2005, *Coalition Urges UN to Consider Legislation to Curb Harmful Ocean Sounds* in June 2005, and other previous environmental security reports on the same issue.]

Military Implications:

As pointed out by Joel Reynolds, a senior attorney at the Natural Resources Defense Council (NRDC) and director of its Marine Mammal Protection Project, "this settlement confirms that measures to protect our oceans can and must be part of the Navy's training for submarine defense." Although this time a settlement was reached, it is likely that at some point, in case of more evidence that sonars are harmful, or more pressure from conservation groups, they might be banned completely. In any event, monitoring of marine mammals' presence in case of sonar use should become incorporated in Navy policy.

Sources:

Court Allows Sonar in RIMPAC War Games With New Restrictions

<http://www.ens-newswire.com/ens/jul2006/2006-07-09-01.asp>

U.S. Judge Blocks Navy Use of Sonar in RIMPAC War Games

<http://www.ens-newswire.com/ens/jul2006/2006-07-03-05.asp>

6.8 Air Pollution Control Might Increase

6.8.1 Polluted Skies and Global Warming Puzzle Decoded

A team of U.S. and Israeli scientists seem to have found the link between global warming and cloud formation. The pattern they identified shows that light-reflecting pollution favors cloud formation, while light-absorbing aerosols impede it by warming the air, which impedes moisture condensation. This finding helps better understand and predict climate change, as well as the role of different kinds of pollution in cloud formation and rain activity.

Military Implications:

This new discovery might increase attention to different pollutants, and consequently change or trigger new regulations globally or by region, pending on weather patterns. Also, since weather conditions (floods, drought, and related consequences) are increasingly incorporated in human security strategies, the new findings might be useful to military activities relying on rain patterns.

Sources:

Polluted Skies and Global Warming Puzzle Decoded

<http://www.ens-newswire.com/ens/jul2006/2006-07-14-01.asp>

Air Pollution's Color Determines Its Effect On Clouds

<http://www.jyi.org/news/nb.php?id=745>

6.8.2 European New Web-based Air Pollution Monitoring System

Users of the new Ozone Web released by the European Environment Agency can monitor and track ground level ozone across Europe. The Web site-based database is updated on an hourly basis with data from more than 500 air quality monitoring stations. Users can access the information on air quality in any part of Europe either by entering a place name or by clicking on a map of Europe. The Web site will also include information on the health implications of the respective ozone values.

Military Implications:

Considering the increased role of citizens in shaping Europe's regulations, it is reasonable to speculate that such Web-based information accompanied by health implications related to air pollution might trigger requests for even more stringent regulations on pollutants across Europe. The impacts of military bases could be made more evident and objective with such a system than has been true in the past.

Sources:

New web-based air pollution monitoring system

<http://org.eea.europa.eu/documents/newsreleases/Ozone2006-en>

The Ozone Web

<http://www.eea.europa.eu/maps/ozone/welcome>

Item 7. Reports Suggested for Review**7.1 Rising Sea Waters Linked to Loss of Pacific Islands Mangroves**

UNEP's Regional Seas Programme published a study *Pacific Island Mangroves in a Changing Climate and Rising Seas*. The report assessed 16 Pacific island countries and concluded that as much as 13 percent of mangroves in the Pacific could be lost by the end of the century. Mangroves play a crucial role with terrestrial and marine ecosystems and their loss can impact human populations. Island states most vulnerable include Tuvalu, Fiji, and American Samoa. Rising seawaters contributes to the loss of mangroves and will also further increase the relocation of island citizens to safer grounds.

Military Implications:

U.S. military should continue to monitor the loss of mangroves and its effects on local Pacific island populations along with rising seawaters. Contingency plans should be created to aid populations that will need to relocate.

Source:

Climate change threatens Pacific Ocean mangroves – UN-backed report

<http://www.un.org/apps/news/story.asp?NewsID=19226&Cr=UNEP&Cr1=>

“Pacific Island Mangroves in a Changing Climate and Rising Seas”

<http://www.unep.org/PDF//mangrove-report.pdf>

7.2 Recent Reports on Nanotechnology

7.2.1 Nanotechnology Risk Governance—White Paper:

The International Risk Governance Council (www.irgc.org) has issued a white paper, *Nanotechnology Risk Governance*, which uses the IRGC’s risk governance framework, published in 2005, to analyze and identify current deficits in nanotechnology risk governance, separately considering current and future developments. It then offers initial recommendations for how decision makers may choose to deal with these risk governance gaps. These recommendations will be subject to further work, including discussions with appropriate stakeholders.

7.2.2 UNESCO Report on the Ethics and Politics of Nanotechnology

The UNESCO World Commission on the Ethics of Scientific Knowledge and Technology has published a 25-page report, *The Ethics and Politics of Nanotechnology*. The work discusses "Nanotechnology Research Now" and "Ethical, legal, and political implications of nanotech", and it concludes with a list of the most recent reports that have been released covering nanotechnology, its implications, and the social, political and ethical issues surrounding it.

7.2.3 EC Committee Issues Nanotech Risk Methodology Opinion

The European Commission Scientific Committee on Emerging and Newly Identified Health Risks has issued a 79-page "modified opinion" on the appropriateness of existing methodologies to assess the potential risks associated with engineered and adventitious products of nanotechnologies. This report discusses in detail the scientific rationale, including risk assessment methodologies and prioritization of needs in knowledge, and concludes with Committee and minority opinions, and references.

Military Implications:

Relevant military personnel should review these publications for the possible effects of their recommendations on future regulations and agreements affecting military R&D, planning and operations that could use future nanotechnology.

Sources:

Nanotechnology Risk Governance

http://www.irgc.org/irgc/_b/contentFiles/IRGC_white_paper_2_PDF_final_version.pdf

The Ethics and Politics of Nanotechnology

Report: <http://unesdoc.unesco.org/images/0014/001459/145951e.pdf>

SCIENTIFIC COMMITTEE ON EMERGING AND NEWLY IDENTIFIED HEALTH RISKS

(SCENIHR) modified Opinion (after public consultation) on The appropriateness of existing methodologies to assess the potential risks associated with engineered and adventitious products of nanotechnologies

http://ec.europa.eu/health/ph_risk/committees/04_scenih/docs/scenih_o_003b.pdf

APPENDIX

Reference Details

This Appendix contains expanded background information on some items, and the full text for the articles that are not available on the Internet or are usually stored for a limited time on the respective Web sites.

Item 2. Better International Controls Needed to Prevent Bioterrorism

Custom-Built Pathogens Raise Bioterror Fears

By Joby Warrick

Washington Post Staff Writer

Monday, July 31, 2006; A01

<http://www.washingtonpost.com/wp-dyn/content/article/2006/07/30/AR2006073000580.html> (by subscription only)

Eckard Wimmer knows of a shortcut terrorists could someday use to get their hands on the lethal viruses that cause Ebola and smallpox. He knows it exceptionally well, because he discovered it himself.

In 2002, the German-born molecular geneticist startled the scientific world by creating the first live, fully artificial virus in the lab. It was a variation of the bug that causes polio, yet different from any virus known to nature. And Wimmer built it from scratch.

The virus was made wholly from nonliving parts, using equipment and chemicals on hand in Wimmer's small laboratory at the State University of New York here on Long Island. The most crucial part, the genetic code, was picked up for free on the Internet. Hundreds of tiny bits of viral DNA were purchased online, with final assembly in the lab.

Wimmer intended to sound a warning, to show that science had crossed a threshold into an era in which genetically altered and made-from-scratch germ weapons were feasible. But in the four years since, other scientists have made advances faster than Wimmer imagined possible. Government officials, and scientists such as Wimmer, are only beginning to grasp the implications.

"The future," he said, "has already come."

Five years ago, deadly anthrax attacks forced Americans to confront the suddenly real prospect of bioterrorism. Since then the Bush administration has poured billions of dollars into building a defensive wall of drugs, vaccines and special sensors that can detect dangerous pathogens. But already, technology is hurtling past it. While government scientists press their search for new drugs for old foes such as classic anthrax, a revolution in biology has ushered in an age of engineered microbes and novel ways to make them.

The new technology opens the door to new tools for defeating disease and saving lives. But today, in hundreds of labs worldwide, it is also possible to transform common intestinal microbes into killers. Or to make deadly strains even more lethal. Or to resurrect bygone killers, such the 1918 influenza. Or to manipulate a person's hormones by switching genes on or off. Or to craft cheap, efficient delivery systems that can infect large numbers of people.

"The biological weapons threat is multiplying and will do so regardless of the countermeasures we try to take," said Steven M. Block, a Stanford University biophysicist and former president of the Biophysical Society. "You can't stop it, any more than you can stop the progress of mankind. You just have to hope that your collective brainpower can muster more resources than your adversaries'."

The Bush administration has acknowledged the evolving threat, and last year it appointed a panel of scientists to begin a years-long study of the problem. It also is building a large and controversial lab in Frederick, where new bioterrorism threats can be studied and tested. But overall, specific responses have been few and slow.

The U.S. Centers for Disease Control and Prevention has declined so far to police the booming gene-synthesis industry, which churns out made-to-order DNA to sell to scientists. Oversight of controversial experiments remains voluntary and sporadic in many universities and private labs in the United States, and occurs even more rarely overseas.

Bioterrorism experts say traditional biodefense approaches, such as stockpiling antibiotics or locking up well-known strains such as the smallpox virus, remain important. But they are not enough.

"There's a name for fixed defenses that can easily be outflanked: They are called Maginot lines," said Roger Brent, a California molecular biologist and former biodefense adviser to the Defense Department, referring to the elaborate but short-sighted network of border fortifications built by France after World War I to prevent future invasions by Germany.

"By themselves," Brent said, "stockpiled defenses against specific threats will be no more effective to the defense of the United States than the Maginot line was to the defense of France in 1940."
How to Make a Virus

Wimmer's artificial virus looks and behaves like its natural cousin -- but with a far reduced ability to maim or kill -- and could be used to make a safer polio vaccine. But it was Wimmer's techniques, not his aims, that sparked controversy when news of his achievement hit the scientific journals.

As the creator of the world's first "de novo" virus -- a human virus, at that -- Wimmer came under attack from other scientists who said his experiment was a dangerous stunt. He was accused of giving ideas to terrorists, or, even worse, of inviting a backlash that could result in new laws restricting scientific freedom.

Wimmer counters that he didn't invent the technology that made his experiment possible. He only drew attention to it.

"To most scientists and lay people, the reality that viruses could be synthesized was surprising, if not shocking," he said. "We consider it imperative to inform society of this new reality, which bears far-reaching consequences."

One of the world's foremost experts on poliovirus, Wimmer has made de novo poliovirus six times since his groundbreaking experiment four years ago. Each time, the work is a little easier and faster.

New techniques developed by other scientists allow the creation of synthetic viruses in mere days, not weeks or months. Hardware unveiled last year by a Harvard genetics professor can churn out synthetic genes by the thousands, for a few pennies each.

But Wimmer continues to use methods available to any modestly funded university biology lab. He reckons that tens of thousands of scientists worldwide already are capable of doing what he does.

"Our paper was the starting point of the revolution," Wimmer said. "But eventually the process will become so automated even technicians can do it."

Wimmer's method starts with the virus's genetic blueprint, a code of instructions 7,441 characters long. Obtaining it is the easiest part: The entire code for poliovirus, and those for scores of other pathogens, is available for free on the Internet.

Armed with a printout of the code, Wimmer places an order with a U.S. company that manufactures custom-made snippets of DNA, called oligonucleotides. The DNA fragments arrive by mail in hundreds of tiny vials, enough to cover a lab table in one of Wimmer's three small research suites.

Using a kind of chemical epoxy, the scientist and his crew of graduate assistants begin the tedious task of fusing small snippets of DNA into larger fragments. Then they splice together the larger strands until the entire sequence is complete.

The final step is almost magical. The finished but lifeless DNA, placed in a broth of organic "juice" from mashed-up cells, begins making proteins. Spontaneously, it assembles the trappings of a working virus around itself.

While simple on paper, it is not a feat for amateurs, Wimmer said. There are additional steps to making effective bioweapons besides acquiring microbes. Like many scientists and a sizable number of biodefense experts, Wimmer believes traditional terrorist groups such as al-Qaeda will stick with easier methods, at least for now.

Yet al-Qaeda is known to have sought bioweapons and has recruited experts, including microbiologists. And for any skilled microbiologist trained in modern techniques, Wimmer acknowledged, synthetic viruses are well within reach and getting easier.

"This," he said, "is a wake-up call."

From Parlor Trick to Bio-Bricks

The global biotech revolution underway is more than mere genetic engineering. It is genetic engineering on hyperdrive. New scientific disciplines such as synthetic biology, practiced not only in the United States but also in new white-coat enclaves in China and Cuba, seek not to tweak biological systems but to reinvent them.

The holy grail of synthetic biologists is the reduction of all life processes into building blocks -- interchangeable bio-bricks that can be reassembled into new forms. The technology envisions new species of microbes built from the bottom up: "living machines from off-the-shelf chemicals" to suit the needs of science, said Jonathan Tucker, a bioweapons expert with the Washington-based Center for Non-Proliferation Studies.

"It is possible to engineer living organisms the way people now engineer electronic circuits," Tucker said. In the future, he said, these microbes could produce cheap drugs, detect toxic chemicals, break down pollutants, repair defective genes, destroy cancer cells and generate hydrogen for fuel.

In less than five years, synthetic biology has gone from a kind of scientific parlor trick, useful for such things as creating glow-in-the-dark fish, to a cutting-edge bioscience with enormous commercial potential, said Eileen Choffnes, an expert on microbial threats with the National Academies' Institute of Medicine. "Now the technology can be even done at the lab bench in high school," she said.

Along with synthetic biologists, a separate but equally ardent group is pursuing DNA shuffling, a kind of directed evolution that imbues microbes with new traits. Another faction seeks novel ways to deliver chemicals and medicines, using ultra-fine aerosols that penetrate deeply into the lungs or new forms of microencapsulated packaging that control how drugs are released in the body.

Still another group is discovering ways to manipulate the essential biological circuitry of humans, using chemicals or engineered microbes to shut down defective genes or regulate the production of hormones controlling such functions as metabolism and mood.

Some analysts have compared the flowering of biotechnology to the start of the nuclear age in the past century, but there are important differences. This time, the United States holds no monopoly over the emerging science, as it did in the early years of nuclear power. Racing to exploit each new discovery are dozens of countries, many of them in the developing world.

There's no binding treaty or international watchdog to safeguard against abuse. And the secrets of biology are available on the Internet for free, said Robert L. Erwin at a recent Washington symposium pondering the new technology. He is a geneticist and founder of the California biotech firm Large Scale Biology Corp.

"It's too cheap, it's too fast, there are too many people who know too much," Erwin said, "and it's too late to stop it."

A Darker Side

In May, when 300 synthetic biologists gathered in California for the second national conference in the history of their new field, they found protesters waiting.

"Scientists creating new life forms cannot be allowed to act as judge and jury," Sue Mayer, a veterinary cell biologist and director of GeneWatch UK, said in a statement signed by 38 organizations.

Activists are not the only ones concerned about where new technology could lead. Numerous studies by normally staid panels of scientists and security experts have also warned about the consequences of abuse. An unclassified CIA study in 2003 titled "The Darker Bioweapons Future" warned of a potential for a "class of new, more virulent biological agents engineered to attack" specific targets. "The effects of some of these engineered biological agents could be worse than any disease known to man," the study said.

It is not just the potential for exotic diseases that is causing concern. Harmless bacteria can be modified to carry genetic instructions that, once inside the body, can alter basic functions, such as immunity or hormone production, three biodefense experts with the Defense Intelligence Agency said in an influential report titled "Biotechnology: Impact on Biological Warfare and Biodefense."

As far as is publicly known, no such weapons have ever been used, although Soviet bioweapons scientists experimented with genetically altered strains in the final years of the Cold War. Some experts doubt terrorists would go to such trouble when ordinary germs can achieve the same goals.

"The capability of terrorists to embark on this path in the near- to mid-term is judged to be low," Charles E. Allen, chief intelligence officer for the Department of Homeland Security, said in testimony May 4 before a panel of the House Committee on Homeland Security. "Just because the technology is available doesn't mean terrorists can or will use it."

A far more likely source, Allen said, is a "lone wolf": a scientist or biological hacker working alone or in a small group, driven by ideology or perhaps personal demons. Many experts believe the anthrax attacks of 2001 were the work of just such a loner.

"All it would take for advanced bioweapons development," Allen said, "is one skilled scientist and modest equipment -- an activity we are unlikely to detect in advance."

Genes for Sale

Throughout the Western world and even in developing countries such as India and Iran, dozens of companies have entered the booming business of commercial gene synthesis. Last fall, a British scientific journal, *New Scientist*, decided to contact some of these DNA-by-mail companies to show how easy it would be to obtain a potentially dangerous genetic sequence -- for example, DNA for a bacterial gene that produces deadly toxins.

Only five of the 12 firms that responded said they screened customers' orders for DNA sequences that might pose a terrorism threat. Four companies acknowledged doing no screening at all. Under current laws, the companies are not required to screen.

In the United States, the federal "Select Agent" rule restricts access to a few types of deadly bacteria, viruses and toxins. But, under the CDC's interpretation of the rule, there are few such controls on transfers of synthetic genes that can be turned into killers. Changes are being contemplated, but for now the gap is one example of technology's rapid advance leaving law and policy behind.

"It would be possible -- fully legal -- for a person to produce full-length 1918 influenza virus or Ebola virus genomes, along with kits containing detailed procedures and all other materials for reconstitution," said Richard H. Ebright, a biochemist and professor at Rutgers University. "It is also possible to advertise and to sell the product, in the United States or overseas."

While scientists tend to be deeply skeptical of government intrusion into their laboratories, many favor closer scrutiny over which kinds of genetic coding are being sold and to whom. Even DNA companies themselves are lobbying for better oversight.

Blue Heron Biotechnology, a major U.S. gene-synthesis company based in suburban Seattle, formally petitioned the federal government three years ago to expand the Select Agent rule to require companies to screen DNA purchases. The company began voluntarily screening after receiving suspicious requests from overseas, including one from a Saudi customer asking for genes belonging to a virus that causes a disease akin to smallpox.

"The request turned out to be legitimate, from a real scientist, but it made us ask ourselves: How can we make sure that some crazy person doesn't order something from us?" said John Mulligan, Blue Heron's founder and chief executive. "I used to think that such a thing was improbable, but then September 11 happened."

Some scientists also favor greater scrutiny -- or at least peer review -- of research that could lead to the accidental or deliberate release of genetically modified organisms.

In theory, such oversight is provided by volunteer boards known as institutional biosafety committees. Guidelines set by the National Institutes of Health call on federally funded schools and private labs to each appoint such a board. A 2004 National Academy of Sciences report recommended that the committees take on a larger role in policing research that could lead to more powerful biological weapons.

In reality, many of these boards appear to exist only on paper. In 2004, the nonprofit Sunshine Project surveyed 390 such committees, asking for copies of minutes or notes from any meetings convened to evaluate research projects. Only 15 institutions earned high marks for showing full compliance with NIH guidelines, said Edward Hammond, who directed the survey. Nearly 200 others who responded had poor or missing records or none at all, he said. Some committees had never met.

Stockpiles Aren't Enough

New techniques that unlock the secrets of microbial life may someday lead to the defeat of bioterrorism threats and cures for natural diseases, too. But today, the search for new drugs of all kinds remains agonizingly slow.

Five years after the Sept. 11 attacks, the federal government budgets nearly \$8 billion annually -- an 18-fold increase since 2001 -- for the defense of civilians against biological attack. Billions have been spent to develop and stockpile new drugs, most of them each tied to a single, well-known bioterrorism threat, such as anthrax.

Despite efforts to streamline the system, developing one new drug could still take up to a decade and cost hundreds of millions of dollars. If successful, the drug is a solution for just one disease threat out of a list that is rapidly expanding to include man-made varieties.

In a biological attack, waiting even a few weeks for new drugs may be disastrous, said Tara O'Toole, a physician and director of the Center for Biosecurity at the University of Pittsburgh Medical Center.

"We haven't yet absorbed the magnitude of this threat to national security," said O'Toole, who worries that the national commitment to biodefense is waning over time and the rise of natural threats such as pandemic flu. "It is true that pandemic flu is important, and we're not doing nearly enough, but I don't think pandemic flu could take down the United States of America. A campaign of moderate biological attacks could."

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The Secretive Fight Against Bioterror

The government is building a highly classified facility to research biological weapons, but its closed-door approach has raised concerns.

By Joby Warrick

Washington Post Staff Writer

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<http://www.washingtonpost.com/wp-dyn/content/article/2006/07/29/AR2006072900592.html?sub=AR> (by subscription only)

On the grounds of a military base an hour's drive from the capital, the Bush administration is building a massive biodefense laboratory unlike any seen since biological weapons were banned 34 years ago.

The heart of the lab is a cluster of sealed chambers built to contain the world's deadliest bacteria and viruses. There, scientists will spend their days simulating the unthinkable: bioterrorism attacks in the form of lethal anthrax spores rendered as wispy powders that can drift for miles on a summer breeze, or common viruses turned into deadly superbugs that ordinary drugs and vaccines cannot stop.

The work at this new lab, at Fort Detrick, Md., could someday save thousands of lives -- or, some fear, create new risks and place the United States in violation of international treaties. In either case, much of what transpires at the National Biodefense Analysis and Countermeasures Center (NBACC) may never be publicly known, because the Bush administration intends to operate the facility largely in secret.

In an unusual arrangement, the building itself will be classified as highly restricted space, from the reception desk to the lab benches to the cages where animals are kept. Few federal facilities, including nuclear labs, operate with such stealth. It is this opacity that some arms-control experts say has become a defining characteristic of U.S. biodefense policy as carried out by the Department of Homeland Security, NBACC's creator.

Since the department's founding in the aftermath of the Sept. 11 attacks, its officials have dramatically expanded the government's ability to conduct realistic tests of the pathogens and tactics that might be used in a bioterrorism attack. Some of the research falls within what many arms-control experts say is a legal gray zone, skirting the edges of an international treaty outlawing the production of even small amounts of biological weapons.

The administration dismisses these concerns, however, insisting that the work of NBACC is purely defensive and thus fully legal. It has rejected calls for oversight by independent observers outside the department's network of government scientists and contractors. And it defends the secrecy as necessary to protect Americans.

"Where the research exposes vulnerability, I've got to protect that, for the public's interest," said Bernard Courtney, NBACC's scientific director. "We don't need to be showing perpetrators the holes in our defense."

Tara O'Toole, founder of the Center for Biosecurity at the University of Pittsburgh Medical Center and an adviser to the Defense Department on bioterrorism, said the secrecy fits a larger pattern and could have consequences. "The philosophy and practice behind NBACC looks like much of the rest of the administration's philosophy and practice: 'Our intent is good, so we can do whatever we want,'" O'Toole said. "This approach will only lead to trouble."

Although they acknowledge the need to shield the results of some sensitive projects from public view, critics of NBACC fear that excessive secrecy could actually increase the risk of bioterrorism. That would happen, they say, if the lab fosters ill-designed experiments conducted without proper scrutiny or if its work fuels suspicions that could lead other countries to pursue secret biological research.

The few public documents that describe NBACC's research mission have done little to quiet those fears. A computer slide show prepared by the center's directors in 2004 offers a to-do list that suggests the lab will be making and testing small amounts of weaponized microbes and, perhaps, genetically engineered viruses and bacteria. It also calls for "red team" exercises that simulate attacks by hostile groups.

NBACC's close ties to the U.S. intelligence community have also caused concern among the agency's critics. The CIA has assigned advisers to the lab, including at least one member of the "Z-Division," an elite group jointly operated with Lawrence Livermore National Laboratory that specializes in analyzing and duplicating weapons systems of potential adversaries, officials familiar with the program confirm.

Bioweapons experts say the nature of the research envisioned for NBACC demands an unusually high degree of transparency to reassure Americans and the rest of the world of the U.S. government's intentions.

"If we saw others doing this kind of research, we would view it as an infringement of the bioweapons treaty," said Milton Leitenberg, a senior research scholar and weapons expert at the University of Maryland's School of Public Policy. "You can't go around the world yelling about Iranian and North Korean programs -- about which we know very little -- when we've got all this going on."

Creating the Weapons of Terrorism

Created without public fanfare a few months after the 2001 anthrax attacks, NBACC is intended to be the chief U.S. biological research institution engaged in something called "science-based threat assessment." It seeks to quantitatively answer one of the most difficult questions in biodefense: What's the worst that can happen?

To truly answer that question, there is little choice, current and former NBACC officials say: Researchers have to make real biological weapons.

"De facto, we are going to make biowarfare pathogens at NBACC in order to study them," said Penrose "Parney" Albright, former Homeland Security assistant secretary for science and technology.

Other government agencies, such as the Centers for Disease Control and Prevention, study disease threats such as smallpox to discover cures. By contrast, NBACC (pronounced EN-back) attempts to get inside the head of a bioterrorist. It considers the wide array of potential weapons available. It looks for the holes in society's defenses where an attacker might achieve the maximum harm. It explores the risks posed by emerging technologies, such as new DNA synthesizing techniques that allow the creation of genetically altered or man-made viruses. And it tries in some cases to test the weapon or delivery device that terrorists might use.

Research at NBACC is already underway, in lab space that has been outsourced or borrowed from the Army's sprawling biodefense campus at Fort Detrick in Frederick. It was at this compound that the U.S. government researched and produced offensive biological weapons from the 1940s until President Richard M. Nixon halted research in 1969. The Army continues to conduct research on pathogens there.

In June, construction began on a \$128 million, 160,000-square-foot facility inside the same heavily guarded compound. Space inside the eight-story, glass-and-brick structure will be divided between NBACC's two major divisions: a forensic testing center tasked with using modern sleuthing

techniques to identify the possible culprits in future biological attacks; and the Biothreat Characterization Center, or BTCC, which seeks to predict what such attacks will look like.

It is the BTCC's wing that will host the airtight, ultra-secure containment labs where the most controversial research will be done. Homeland Security officials won't talk about specific projects planned or underway. But the 2004 computer slide show -- posted briefly on a Homeland Security Web site before its discovery by agency critics prompted an abrupt removal -- offers insight into NBACC's priorities.

The presentation by NBACC's then-deputy director, Lt. Col. George Korch, listed 16 research priorities for the new lab. Among them:

"Characterize classical, emerging and genetically engineered pathogens for their BTA [biological threat agent] potential.

"Assess the nature of nontraditional, novel and nonendemic induction of disease from potential BTA.

"Expand aerosol-challenge testing capacity for non-human primates.

"Apply Red Team operational scenarios and capabilities."

Courtney, the NBACC science director, acknowledged that his work would include simulating real biological threats -- but not just any threats.

"If I hear a noise on the back porch, will I turn on the light to decide whether there's something there, or go on my merry way?" Courtney asked. "But I'm only going to do [research] if I have credible information that shows it truly is a threat. It's not going to be dreamed up out of the mind of a novelist."

Administration officials note that there is a tradition for this kind of biological risk assessment, one that extends at least to the Clinton administration. In the late 1990s, for example, a clandestine project run by the Defense Department re-created a genetically modified, drug-resistant strain of the anthrax bacteria believed to have been made by Soviet bioweaponers. Such research helped the government anticipate and prepare for emerging threats, according to officials familiar with the anthrax study.

Some arms-control experts see the comparison as troubling. They argued, then and now, that the work was a possible breach of a U.S.-negotiated international law.

Legal and Other Pitfalls

The Bush administration argues that its biodefense research complies with the Biological and Toxin Weapons Convention, the 1972 treaty outlawing the manufacture of biological weapons, because U.S. motives are pure.

"All the programs we do are defensive in nature," said Maureen McCarthy, Homeland Security's director of research and development, who oversees NBACC. "Our job is to ensure that the civilian population of the country is protected, and that we know what the threats are."

Current and former administration officials say that compliance with the treaty hinges on intent, and that making small amounts of biowarfare pathogens for study is permitted under a broad interpretation of the treaty. Some also argue that the need for a strong biodefense in an age of genetic engineering trumps concerns over what they see as legal hair-splitting.

"How can I go to the people of this country and say, 'I can't do this important research because some arms-control advocate told me I can't?'" asked Albright, the former Homeland Security assistant secretary.

But some experts in international law believe that certain experiments envisioned for the lab could violate the treaty's ban on developing, stockpiling, acquiring or retaining microbes "of types and in quantities that have no justification" for peaceful purposes.

"The main problem with the 'defensive intent' test is that it does not reflect what the treaty actually says," said David Fidler, an Indiana University School of Law professor and expert on the bioweapons convention. The treaty, largely a U.S. creation, does not make a distinction between defensive and offensive activities, Fidler said.

More practically, arms experts say, future U.S. governments may find it harder to object if other countries test genetically engineered pathogens and novel delivery systems, invoking the same need for biodefense.

Already, they say, there is evidence abroad of what some are calling a "global biodefense boom." In the past five years, numerous governments, including some in the developing world -- India, China and Cuba among them -- have begun building high-security labs for studying the most lethal bacteria and viruses.

"These labs have become a status symbol, a prestige item," said Alan Pearson, a biologist at the Center for Arms Control and Non-Proliferation. "A big question is: Will these labs have transparency?"

Secrecy May Have a Price

When it opens in two years, the NBACC lab will house an impressive collection of deadly germs and teams of scientists in full-body "spacesuits" to work with them. It will also have large aerosol-test chambers where animals will be exposed to deadly microbes. But the lab's most controversial feature may be its secrecy.

Homeland Security officials disclosed plans to contractors and other government agencies to classify the entire lab as a Sensitive Compartmented Information Facility, or SCIF.

In common practice, a SCIF (pronounced "skiff") is a secure room where highly sensitive information is stored and discussed. Access to SCIFs is severely limited, and all of the activity and

conversation inside is presumed to be restricted from public disclosure. There are SCIFs in the U.S. Capitol, where members of Congress are briefed on military secrets. In U.S. nuclear labs, computers that store weapons data are housed inside SCIFs.

Homeland Security officials plan to operate all 160,000 square feet of NBACC as a SCIF. Because of the building's physical security features -- intended to prevent the accidental release of dangerous pathogens -- it was logical to operate it as a SCIF, McCarthy said.

"We need to protect information at a level that is appropriate," McCarthy added, saying she expects much of the lab's less-sensitive work to be made public eventually.

But some biodefense experts, including some from past administrations, viewed the decision as a mistake.

"To overlay NBACC with a default level of high secrecy seems like overkill," said Gerald L. Epstein, a former science adviser to the White House's National Security Council and now a senior fellow with the Center for Strategic and International Studies. While accepting that some secrecy is needed, he said the NBACC plan "sends a message that is not at all helpful."

NBACC officials also have resisted calls for the kind of broad, independent oversight that many experts say is necessary to assure other countries and the American public about their research.

Homeland Security spokesmen insist that NBACC's work will be carefully monitored, but on the department's terms.

"We have our own processes to scrutinize our research, and it includes compliance to the bioweapons convention guidelines as well as scientific oversight," said Courtney, the NBACC scientific director.

In addition to the department's internal review boards, the agency will bring in small groups of "three or four scientists" on an ad-hoc basis to review certain kinds of potentially controversial experiments, Courtney said. The review panels will be "independent," Courtney said, but he noted that only scientists with government security clearances will be allowed to participate.

Some experts have called for unusual forms of oversight, including panels of well-respected, internationally known scientists and observers from overseas. While allowing that the results of some experiments should be kept confidential, O'Toole, of the Center for Biosecurity, argues that virtually everything else at NBACC should be publicly accountable if the United States is to be a credible leader in preventing the proliferation of bioweapons.

"We're going to have to lean over backward," O'Toole said. "We have no leverage among other nation-states if we say, 'We can do whatever we want, but you can't. We want to see your biodefense program, but you can't see ours.' "

In recent weeks, NBACC's first officially completed project has drawn criticism, not because of its methods or procedures, but because heavy classification has limited its usefulness.

The project was an ambitious attempt to assess and rank the threats posed by dozens of different pathogens and delivery systems, drawing on hundreds of studies and extensive computer modeling. When delivered to the White House in January, it was the most extensive survey of its kind, and one that could guide the federal government in making decisions about biodefense spending.

Six months later, no one outside a small group of officials and advisers with top security clearances has seen the results.

"Something this important shouldn't be secret," said Thomas V. Inglesby, an expert at the Center for Biosecurity who serves on a government advisory board that was briefed on the results. "How can we make policy decisions about matters of this scale if we're operating in the dark?"

Tomorrow: A new era of engineered microbes.
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Item 6. Updates on Previously Identified Issues

6.1 UK Proposes Individual Carbon Trading

Miliband unveils carbon swipe-card plan

Guardian Unlimited, Wednesday July 19, 2006
David Adam and David Batty

<http://www.guardian.co.uk/climatechange/story/0,,1824241,00.html> (article accessible free for a limited time; otherwise, subscription required)

The environment minister, David Miliband, today unveiled a radical plan to cut greenhouse gas emissions by charging individuals for the amount of carbon they use.

Under the proposals, consumers would carry bank cards that record their personal carbon usage. Those who use more energy - with big cars and foreign holidays - would have to buy more carbon points, while those who consume less - those without cars, or people with solar power - would be able to sell their carbon points.

Article continues

Mr Miliband denied suggestions that the scheme would penalise the poor, by, for example, forcing the elderly to turn off their central heating in winter to save carbon points.

"The technical work that has been done so far suggests that poorer people would actually do well out of it," the minister told Channel 4 News at Noon.

"It is not the poor who are the biggest emitters of carbon. It is not the poor who have the biggest cars or the biggest holidays or the most aeroplane flights or the most energy inefficient usage."

Under the scheme, all UK citizens from the Queen down would be allocated an identical annual carbon allowance, stored as points on an electronic card similar to Air Miles or supermarket loyalty cards.

Points would be deducted at point of sale for every purchase of non-renewable energy. People who did not use their full allocation, such as families who do not own a car, would be able to sell their surplus carbon points into a central bank.

High energy users could then buy them - motorists who had used their allocation would still be able to buy petrol, with the carbon points drawn from the bank and the cost added to their fuel bills. To reduce total UK emissions, the overall number of points would shrink each year.

Mr Miliband is keen to set up a pilot scheme to test the idea, and has asked officials from four government departments to report on how it could be done.

The move marks the first serious step towards state-enforced limits on the carbon use of individuals, which scientists say may be necessary in the fight against climate change.

It extends the principle of carbon trading - already in place between heavy polluters such as power companies and steelmakers - to consumers, with heavy carbon users forced to buy unused allowances from people with greener lifestyles.

"As a planet we are consuming three times the amount of resources that we have got," the environment secretary told Channel 4 News. "If you think about us as individuals - we are emitting about four tonnes of carbon every year and that's probably three times as much as we can afford; as a household on average 10 tonnes."

The principle was included in the government's review of energy policies, which said a new cross-departmental group "will examine what new policy options, such as tradable personal carbon allowances, could be deployed to stimulate local action".

Mr Miliband will announce more details in a speech tonight to the Audit Commission.

Colin Challen, Labour chairman of the all-party parliamentary group on climate change, which has called for carbon rationing, said: "It will inevitably have to be introduced so that consumers, along with other sectors, take responsibility for what they do."

But setting up a local pilot scheme could have problems - not least how to stop people driving elsewhere to fill up. Mr Challen said: "An island like the Isle of Wight would be an obvious place for a pilot scheme, though I'm not sure how happy they would be with that."