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# WORLDWIDE EMERGING ENVIRONMENTAL ISSUES AFFECTING THE U.S. MILITARY

**Subcontract No: 1048, LMI Task No: MAN0B.04, for the U.S. Army Environmental Policy Institute**

## MAY 2011 REPORT

Note to Readers: Pages 1-14 comprise the summary and analysis of this report. Expanded details for some items are in the Appendix beginning on page 15.

## Item 1. INTERPOL Established Radiological and Nuclear Terrorism Prevention Unit

INTERPOL has established the Radiological and Nuclear Terrorism Prevention Unit to expand beyond its current anti-bioterrorism activities to address chemical, biological, radiological, and nuclear threats. The unit will use intelligence analysis based on an integrated cross-sectoral approach and information sharing among the 188 participating nations and collaboration with national and international specialized organizations. It will provide capacity building and training, as well as operational support through deployment of specialized teams. The Project Geiger database developed in collaboration with the International Atomic Energy Agency and other organizations, lists over 2,500 incidents linked to illegal radiological and nuclear trafficking.

**Military Implications:**
The military will probably be called upon to strengthen cooperation and information sharing and to provide operational support and share know-how with the new counter-WMD INTERPOL effort. If not already established, collaboration would be wise at the outset of this unit's establishment.

**Sources:**
INTERPOL global summit sets course for collaboration and prevention against radiological and nuclear terrorism
http://www.interpol.int/Public/ICPO/PressReleases/PR2011/PR042.asp
Interpol Stands Up Nuclear Counterterrorism Unit
http://gsn.nti.org/gsn/nw_20110519_4421.php

## Item 2. Global Warming Changes Coastal Borders

A three-day gathering of international lawyers, politicians, and UN officials held at Columbia University assessed existing formal and informal rules that would apply to shifting maritime baselines due to climate change. Such situations range from delimitation of maritime economic exploitation zones to continued existence of some nations as legal and sovereign entities. For example, is a nation entitled to economic exploitation zones even if the entire population was forced to relocate elsewhere? Some potential options are updating UNCLOS with a concept of moving maritime baselines, or making permanent the baselines and boundaries of maritime zones of today. President Jurelang Zedkaia of the Marshall Islands requested the UN Security Council to appoint an expert to assist the Council in examining the current and projected effects on vulnerable islands in preparation for the Security Council's July session on the security implications of climate change. [Note: such situations include small island states such as Kitribati, Marshall Islands, and Tuvalu in the Pacific, and Maldives and Seychelles in the Indian Ocean, as well as the dispute over the Spratly Islands in the South China Sea—whether they are islands entitled to an EEZ or just rocks.]

**Military Implications:**
Increased competition for resources and changing maritime baselines could exacerbate conflict situations among states and lead the UN and the international law community to adopt new international regulations. The military should be prepared to comply with new boundaries and sovereignties, and it should as well cooperate with the entities participating in negotiations to ensure that the new system will best serve global peace and world security. The outcomes of the

Columbia University gathering could provide some warnings on how the international law system could evolve in view of new challenges triggered by climate change.

**Sources:**
Island Nations May Keep Some Sovereignty if Rising Seas Make Them Uninhabitable
http://www.nytimes.com/cwire/2011/05/25/25climatewire-island-nations-may-keep-some-sovereignty-if-63590.html
I am a rock, I am an island. How submerged islands could keep their statehood
http://www.economist.com/node/18744261?story_id=18744261
Falling Behind in Ocean Law Development. The Ocean Law Daily, May 26, 2011 (LOSList@oceanlaw.org)
Rising seas threaten Marshall Islands
http://www.philly.com/philly/insights/in_the_know/122814188.html

## Item 3. Russia to Establish "Environmental Barriers" on its Borders

Russia is building "ecological barriers" on its borders to reduce impacts of future international disasters such as the oil spill in the Gulf of Mexico and the Fukushima nuclear disaster. A special network of facilities will reportedly monitor air and water pollution at the border regions, thus allowing timely alerts helping to protect the population when necessary. Although there are no details at this point regarding the types of monitoring instruments, many issues concerning the creation of the ecological shield are reported to have already been agreed to by the Federal Service for Hydrometeorology and Environmental Monitoring, the Natural Resources Ministry, and the state nuclear agency.

**Military Implications:**
This may be a new approach to environmental security that military personnel with environmental security responsibilities should explore. "Environmental barriers" could strengthen enforcement of environmental regulations and increase international environmental cases of liability and redress. Also, the development of such "barriers" should be monitored and measures taken to ensure international transparency.

**Sources:**
Protecting ecological borders of Russia
http://english.ruvr.ru/2011/05/26/50871096.html
Russia needs ecological barrier on borders - emergencies minister
http://en.rian.ru/Environment/20110526/164247550.html

## Item 4. China, Japan, and South Korea Foster Cooperation on Environmental Security

The leaders of China, Japan, and South Korea met in Tokyo on May 21-22 for their fourth trilateral summit to strengthen regional security. Cooperation on non-traditional threats such as nuclear safety, disaster prevention, and food, energy and environmental security topped the agenda. There was consensus that East Asia needs a common disaster prevention and relief system to cope with the increased number, intensity, and consequences of natural disasters affecting the region. Such unconventional security issues, which do not involve ideological differences but constitute serious threats to regional peace and prosperity, call for unconventional

security cooperation models. South Korea will host a related meeting to explore a free trade agreement among the three countries in the first week of June.

**Military Implications:**
The military should reinforce environmental security with its counterparts as a key focus for such regional cooperation and seek opportunities to apply the Army Strategy for the Environment in the evolution of these trilateral summits.

**Sources:**
Eyes on East Asian Future
http://www.tehrantimes.com/index_View.asp?code=241427
South Korea to Host Forum on FTA with China, Japan
http://www.bernama.com/bernama/v5/newsworld.php?id=589172
Asia's Threesome Turns Four
http://www.project-syndicate.org/commentary/yoon6/English

## Item 5. The World Meteorological Organization to Expand Scope of Work

The World Meteorological Congress meets every four years to set the agenda for the World Meteorological Organization (WMO). The focus of the 16th World Meteorological Congress, held in Geneva, May16-June 3, 2011 is strengthening the WMO's program in the context of increased likelihood and impact of extreme weather and climate-related hazards. Future priorities include: continuous science and technology development and implementation; further development of the concept of hydrometeorological security; global framework improvement for climate services and better integration of global observing and information systems; disaster risk reduction; aeronautical meteorology program improvement for assisting air traffic management; and capacity building (mostly in developing countries) for spreading the benefits of WMO's activities. The outcomes of the Congress were not yet available at the time of this writing.

**Military Implications:**
In view of increasing importance of weather-related events to global security, and growing military involvement in responding to natural disasters, collaboration with the WMO is likely to increase. Hence, relevant military personal should study the results of the World Meteorological Congress with special attention to the evolution of the concept of hydrometeorological security.

**Source:**
Sixteenth World Meteorological Congress
http://www.wmo.int/pages/prog/lsp/congress/index_en.php

## Item 6. ISO 50001 Standard on Energy Management Systems

The International Organization for Standardization is in the process of releasing *ISO 50001 Energy management systems -- Requirements with guidance for use*. While ISO 50001:2011 applies to all energy performance variables that can be monitored and managed, it "does not prescribe specific performance criteria with respect to energy."

**Military Implications:**
Military personnel involved in energy management should review ISO 50001 for potential applications to the military and their contractors.

**Sources:**
Understanding ISO 50001 Energy Management System Standard and its Integration with an EMS
http://e2s2.ndia.org/schedule/Documents/Abstracts/12196.pdf
ISO/FDIS 50001 Energy management systems -- Requirements with guidance for use
http://www.iso.org/iso/iso_catalogue/catalogue_tc/catalogue_detail.htm?csnumber=51297

## Item 7. Technological Advances with Environmental Security Implications

### 7.1 New Algorithm Yields More Efficient Environmental Search Patterns

According to a news release, Prof. Daniela Rus, of the University of Waterloo, Ontario, and colleagues planned to present a paper to the May 2011 Institute of Electronic and Electrical Engineers Conference that describes "a new algorithm enabling sensor-laden robots to focus on the parts of their environments that change most frequently, without losing track of the regions that change more slowly". The new technique should increase efficiencies of collecting data on large expanses of land and sea environments.

**Military Implications:**
The military should evaluate this technique for the full-range of environmental monitoring.

**Source:**
Speeding swarms of sensor robots
http://web.mit.edu/newsoffice/2011/robot-algorithm-0503.html

### 7.2 Self-cleaning, Smog-reducing Aluminum Panels for Building Construction

Alcoa and Japanese manufacturer Toto have announced “Reynobond with EcoClean”, a line of aluminum panels for building construction that have a hydrophilic titanium dioxide coating to which has been applied a Toto chemical, Hydrotect, that breaks down organic material. Exposure of the panel to UV, as in sunlight, triggers a chemical reaction that produces an anti-microbial surface that is cleaned by rain and is also claimed to remove nitrous and sulfuric oxides from the air.

**Military Implications:**
After these characteristics and claims are verified, this product might offer significant advantages for environment-friendly construction.

**Sources:**
Alcoa http://alcoa.com/bcs/aap_eastman/ecoclean/en/home.asp
Toto http://www.totousa.com/WhyTOTO/Innovation/Hydrotect.aspx
Alcoa, Toto unveil green building panels that eat smog
http://www.smartplanet.com/blog/smart-takes/alcoa-toto-unveil-green-building-panels-that-eat-smog/16182?tag=nl.e099

## 7.3 New Detection and Cleanup Techniques

### 7.3.1 Chirped THz Radiation Provides Fast, Sensitive Trace Gas Detection

Chemists at the National Institute of Standards and Technology have found a way of sweeping a THz radiator from 550 to 561 GHz in 100 nanoseconds, to simultaneously detect many different trace gases at very fast rates and sensitivity in the low parts per billion (ppb) range. This technique replaces the "one frequency at a time" approach previously required.

**Military Implications:**
This technique's implications for fast, effective environmental assessment systems should be investigated.

**Sources:**
Secret behind NIST's new gas detector? Chirp before sniffing
http://www.physorg.com/news/2011-05-secret-nist-gas-detector-chirp.html
Chirped-pulse terahertz spectroscopy for broadband trace gas sensing
http://www.opticsinfobase.org/abstract.cfm?URI=oe-19-9-8973

### 7.3.2 Grating-Coupled Porous Silicon Waveguide Provides Sensitive New Sensor

Xing Wei and Prof. Sharon M. Weiss, of Vanderbilt University, Nashville TN, have developed a new molecular matching platform for such applications as DNA sequence or environmental toxin detection. The key to the new approach is the use of a porous silicon substrate to hold the molecules to be matched. With a 3 cm cube, the pores provide a 10,000 times increase in the surface area available for molecule attachment. A grating structure of the sensor allows photometric measurement of the quantity sensed, as well as its identity.

**Military Implications:**
This development should be explored for its possible use in environmental assessment systems.

**Sources:**
Improving DNA sequencing: Sponge-like biosensor crams enormous power into tiny space
http://www.nanowerk.com/news/newsid=21511.php
Guided mode biosensor based on grating coupled porous silicon waveguide
http://www.opticsinfobase.org/oe/abstract.cfm?uri=oe-19-12-11330

## 7.4 Water Testing and Cleaning Techniques

### 7.4.1 New Alloy Generates Pure Water and Hydrogen

A news release describes a new alloy of aluminum, gallium, indium, and tin, developed by Prof. Jerry Woodall and Go Choi of Purdue University, that, when dropped into water, "causes a spontaneous reaction, turning the water into steam and generating hydrogen and aluminum tri-hydroxide until the aluminum is used up". The steam can be condensed into potable water, and the hydrogen can be used to power a fuel cell to generate electricity, thus providing two elements useful for survival in an undeveloped environment. The inventors estimate costs of about $1/gal and $0.35/kwh.

**Military Implications:**
This invention should be considered as a possible simple technique for providing water and energy to components operating in an emergency, undeveloped environment. Gallium and

indium wastes should be assessed for toxicity when discarded to the environment. The entire concept needs to be evaluated for lifecycle environmental costs versus benefits.

**Source:**
Portable tech might provide drinking water, power to villages
http://www.purdue.edu/newsroom/research/2011/110503WoodallWater.html

7.4.2 New Detection Systems for Contaminated Water

The EC FP6 project, DINAMICS (DIagnostic NAnotech and MICrotech Sensors), has developed a lab-on-a-chip device that can monitor water and detect different pathogens even at very low concentrations. According to *Nanowerk News*, "the device uses sensors with very small strands of different pathogenic DNA integrated onto their surfaces to quickly recognize pathogenic DNA from water samples. The DNA in the sensors will only bind to the water samples' corresponding DNA". The reaction is detected electronically or by UV light absorption. The Fraunhofer Institute in Germany has developed a different contamination detection system, based on releasing microorganisms into the sample and then analyzing, by computer, live microimages of their condition and behavior.

**Military Implications:**
These systems should be evaluated for their usefulness in environmental assessment.

**Sources:**
Diagnostic Nanotech and Microtech Sensors
http://www.dinamics-project.eu/
AquaBioTox sensor concept
http://www.iosb.fraunhofer.de/servlet/is/25278/
A new detection system can reveal bioterrorist attacks on our water supply network
http://www.nanowerk.com/news/newsid=21253.php

7.4.3 Antibodies-based Sensor Offers Fast Detection of Petroleum Chemicals in Water

Prof. Michael Unger of the College of William and Mary's Virginia Institute of Marine Science, Gloucester Point VA, working with Sapidyne Instruments, Boise ID, has announced the development of a sensor which uses antibodies to detect and measure contaminants, such as polycyclic aromatic hydrocarbons (PAHs), in water. The antibodies, which carry fluorescent tags, are produced from mouse cells that have been sensitized to a protein to which has been attached an analog of the contaminant of interest. Results down to the ppb level can be produced in a matter of minutes.

**Military Implications:**
This technology should be investigated for its applicability in environmental assessment.

**Source:**
Detecting marine pollutants with an antibody-based sensor
http://www.smartplanet.com/blog/pure-genius/detecting-marine-pollutants-with-an-antibody-based-sensor/6241?tag=nl.e660

## 7.5 Increasing Energy Efficiency Technologies

### 7.5.1 New Nanocone Structure Increases Solar Cell Efficiency

A team led by Jun Xu, of the Oak Ridge National Laboratory's Chemical Sciences Div., has developed a new 3D structure for solar cells that increases the light-to-power conversion efficiency of a photovoltaic device by nearly 80%. The new element consists of zinc oxide n-type nanocones surrounded by a p-type polycrystalline cadmium telluride semiconductor matrix.

**Military Implications:**
This line of development should be followed for its potential in increasing renewable energy source efficiency.

**Source:**
3-D nanocone solar cell technology cranks up efficiency
http://www.nanowerk.com/news/newsid=21188.php

### 7.5.2 A High-Performance Solar-Thermoelectric Generating Device

According to an article in kurzweilai.net, Zhifeng Ren and Gang Chen, of MIT, and their collaborators have produced a solar-thermoelectric generating device with roughly eight times the efficiency of previous designs. It consists of a thermoelectric generator, placed inside a glass vacuum chamber and covered with a black copper plate that absorbs sunlight but does not reradiate it as heat. It requires much less material than conventional photovoltaic panels; therefore, it is cheaper. It can also be integrated into solar hot-water systems.

**Military Implications:**
This development should be followed as it attempts to become competitive with photovoltaic systems.

**Sources:**
A high-performance solar-thermoelectric generating device
http://www.kurzweilai.net/a-high-performance-solar-thermoelectric-generating-device
High-performance flat-panel solar thermoelectric generators with high thermal concentration
http://www.nature.com/nmat/journal/vaop/ncurrent/full/nmat3013.html

### 7.5.3 High-Efficiency Thermal Waste Heat Energy Converter

Scott Hunter, of the Oak Ridge National Laboratory, and his team have developed a high-efficiency thermal waste heat energy converter that actively cools electronic devices and other waste heat-producing systems while generating electricity. The technology uses cantilever pyroelectric capacitor structures about 1 mm square in size, thousands of which can be attached to a 1-inch square surface on the subject element. These structures bend back and forth between hot and cold regions, generating electricity in the process. The team expects to achieve efficiencies of 10 to 30 percent in temperature gradients of a few degrees up to several hundred degrees.

**Military Implications:**
This technology should be followed, as a means of reducing equipment environmental thermal footprints while serving as a renewable energy source.

**Sources:**
Energy harvesters transform waste into electricity
http://www.physorg.com/news/2011-05-energy-harvesters-electricity.html

Energy harvesters transform waste into electricity
http://www.nanowerk.com/news/newsid=21370.php

## Item 8. Updates on Previously Identified Issues

### 8.1 International Nuclear Safety Regulations to be Strengthened and Enforced

As a result of the Japanese nuclear disaster, many nations are changing their nuclear policies (EU Commission President and leaders of the G-8 are calling for a review of the International Atomic Energy Agency's nuclear safety convention). Russia proposed making the IAEA's safety standards mandatory and enforceable and restricting reactors' construction in earthquake-prone areas. A UN summit on nuclear safety will be held on September 22 in New York. Japan and the IAEA will host an international conference on nuclear safety in 2012. Germany and Switzerland plan to phase out nuclear power. Tokyo Electric Power Co. admitted that about 57 metric tons of radiation-tainted water leaked. Several impact studies are underway. [Related item: *Earthquakes, Tsunamis, and Nuclear Disasters in Japan* in March 2011 report.]

**Military Implications:**
[Similar to previous on this issue] This complex environmental disaster should be cited to expand military-to-military resilience training and to develop a comprehensive international framework with relevant international organizations and counterparts for response to natural and nuclear disasters.

**Sources:** (expanded list in the Appendix)
Fukushima: How Many Chernobyls Is It?
http://www.veteranstoday.com/2011/05/28/fukushima-how-many-chernobyls-is-it/
'End the Epoch of Atomic Madness' in the EU
http://www.spiegel.de/international/germany/0,1518,765066,00.html
Japan sets up independent panel probing Fukushima crisis
http://mdn.mainichi.jp/mdnnews/news/20110524p2g00m0dm070000c.html
U.N. body to probe Fukushima radiation impact
http://www.reuters.com/article/2011/05/23/us-japan-fukushima-un-idUSTRE74M3VT20110523

### 8.2 UN StEP Project Tackles Flow of Electronic Waste

The EPA has pledged $2.5 million over the next five years in a joint program with UN StEP (Solve The e-waste Problem) to track US electronic waste as it flows overseas. [Related item: *Hazardous E-waste Grows as Major Environmental Problem* in November 2010 report.]

**Military Implications:**
Military organizations involved with electronic waste should take steps to cooperate with the EPA in this effort.

**Sources:**
US Teams with Global Partners to Curb E-waste
http://www.step-initiative.org/news.php?id=0000000163 U.N. to track flow of U.S. electronic waste to Asia and Africa
http://www.nydailynews.com/lifestyle/2011/05/02/2011-05-02_un_to_track_flow_of_us_electronic_waste_to_asia_and_africa.html

### 8.3 Discharge Requirements for the Wider Caribbean Region Special Area under MARPOL Annex V Regulations Came into Effect on May 1, 2011

Discharge requirements for the Wider Caribbean Region Special Area under MARPOL Annex V Regulations for the prevention of pollution by garbage from ships came into effect on May 1, 2011. No garbage, except food wastes under certain conditions, may be discharged into the sea from vessels operating in the Wider Caribbean Region. [Related item: *New Measure to Enforce Maritime Environmental Protection* in March 2010 report.]

**Military Implications:**

Military entities and their contractors operating in the Caribbean, Gulf of Mexico, or adjacent waters should ensure compliance with this new requirement.

**Sources:**

MARPOL's "special area" garbage discharge restrictions extended to the Wider Caribbean Region
http://www.lexology.com/library/detail.aspx?g=3083d821-22a2-48a1-92f2-04ca2f0aaeb4
Notice of Entry Into Effect of MARPOL Annex V Wider Caribbean Region Special Area
http://www.gpo.gov/fdsys/pkg/FR-2011-04-07/pdf/2011-8244.pdf

### 8.4 IMO Guidelines on the Use of Private Armed Guards to Protect Ships from Piracy

The International Maritime Organization is issuing "interim recommendations" on the use of private armed guards to protect ships from piracy. The recommendations, acting as guidelines, are to be reviewed in September. Observers say that the ratio of one in ten ships off the Somali coast already carrying armed guards is now likely to rise. Four hundred eighty-nine acts of piracy and armed robbery against ships were reported to IMO in 2010, up from 406 in 2009. [Related item: *Somali Piracy is also an Eco-terrorism Threat* in December 2008 report.]

**Military Implications:**

Although the guidelines apparently are for private security entities, the military involved in the anti-piracy actions should also consider them for general consistency of actions, as well as to provide feedback for suggesting and responding to improvements at the September review.

**Source:**

Interim guidance on use of privately contracted armed security personnel on board ships agreed by IMO Maritime Safety meeting
http://www.imo.org/mediacentre/pressbriefings/pages/27-msc-89-piracy.aspx
Piracy: IMO guidelines on armed guards on ships
http://www.bbc.co.uk/news/world-africa-13486015

### 8.5 New Developments for Strengthening Cybersecurity

Cybersecurity was a key issue on the agenda of the G-8 Summit in Deauville, France. The EU will create a new cyber-defense unit that will pull together IT departments from the European Commission, Parliament, and Council to share intelligence and address attacks on all EU bodies, while Estonian Defense Minister Mart Laar has proposed the formation of a joint cyber security unit between the Baltic and Nordic nations. The U.S. has released its plan to protect the nation's cyber infrastructure. Among other directives, the plan includes providing immunity to private organizations that make user data available to investigators of cybercrimes and leaves on the table the option of a military response to cyber attacks. The U.S. also announced cooperation on cybersecurity with the UK and India. Meanwhile, Iranian Intelligence Minister Heidar Moslehi

urged stronger domestic cybersecurity measures following rumors of another Stuxnet-type virus, named "Stars". [Related item: *NATO Continues to Develop Cyber Defense Policies* in January 2011, *The EU Strengthens Legislation to Counter Cybercrime* in December 2010, *International Legal Frameworks Needed for Cybersecurity* in April 2010 environmental security report.]

**Military Implications:**
As cyberspace is increasingly recognized as a "fifth battlespace," actions for international regulations are accelerating. The military should continue to pursue opportunities to forge cooperative international agreements and pursue international legal frameworks to counter malevolent cyber activity.

**Sources:** (expanded list in the Appendix)
EU Institutions to Create New Cyber Defense Unit
http://euobserver.com/18/32368
Sarkozy prioritises internet regulation at G8 summit – Telegraph
http://www.cyber-defense.net/news/sarkozy-prioritises-internet-regulation-at-g8-summit-telegraph/
Minister Urges Stronger Cyber Security Measures in Iranian Organizations
http://english.farsnews.com/newstext.php?nn=9003071319

### 8.6 Chemical Weapons Disposal Deadlines Will Not Be Met

The war in Libya makes it impossible for that country to meet the deadlines of May 15 to destroy its cache of mustard gas and December 31 to eliminate its precursor agents, as requested by the Chemical Weapons Convention. Japan's nuclear and environmental disasters might further delay efforts to complete its obligations to dispose of the chemical munitions in China. The U.S. and Russia are also unlikely to meet the 2012 deadline for eliminating their respective stockpiles of chemical warfare materials. As of end of April 2011, the U.S. has destroyed about 86% of the warfare agents it held when the treaty entered into force in 1997, while Russia had destroyed about 49% of its stockpile as of February 2011, according to authoritative sources. Meanwhile, potential old chemical weapons stockpiles left at former U.S. bases in South Korea were revealed. [Related item: *Chemical Weapons Convention Gets New Boost* in April 2008 report.]

**Military Implications:**
Military with responsibilities in this area should consider assessing national and international opportunities for assisting in compliance and improving effectiveness of the CWC regulations. Also, in view of the new developments, the international community might reconsider stipulations related to special cases, as the current one in Libya and eventual extensions in Japan's case.

**Sources:**
Libya Fails to Destroy Mustard Agent by Treaty Deadline
http://gsn.nti.org/gsn/nw_20110518_7424.php
One Year to U.S, Russian Chemical Weapons Disposal Deadline
http://gsn.nti.org/gsn/nw_20110429_2863.php
South Korea probes second report of US army chemical dumping
http://www.reuters.com/article/2011/05/25/us-korea-usa-idUSTRE74O3U420110525

### 8.7 Large Scale Cadmium Ban under EU REACH from December 2011

The European Commission has banned cadmium use in all jewelry products, plastics, and brazing sticks from December 2011. The new legislation also promotes the recovery of PVC waste and reuse of recovered PVC containing low levels of cadmium in a limited number of construction products, which should be specifically labeled. [Related items: *The Protocol on Heavy Metals entered into force on 29 December 2003* in October 2003 and *EU to Ban the use of Cadmium in Batteries* in December 2004 reports.]

**Military Implications**

Military with environmental regulation compliance responsibilities in Europe and military contractors should study the new requirements for implications and procedures for disposal. Research for cadmium substitutes should be reviewed for applications to comply with the new regulations.

**Source:**

Chemicals/REACH: EU to ban cadmium in jewellery, brazing sticks and all plastics
http://europa.eu/rapid/pressReleasesAction.do?reference=IP/11/620&format=HTML&aged=0&language=EN&guiLanguage=en

### 8.8 Arctic Governance Mechanisms Continue to Grow

The Seventh Ministerial Meeting of the Arctic Council was held on 12 May 2011, in Nuuk, Greenland, and concluded with the adoption of the Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic. This is the first legally binding agreement negotiated by the Council. The Arctic Monitoring and Assessment Programme released the report *Snow, Water, Ice, and Permafrost in the Arctic*, during the meeting. It summarizes the results of a multi-year study contributed to by experts of all eight Arctic states. It notes that the period 2005-2010 has been the warmest ever recorded in the region. Permafrost temperatures have risen by up to 2ºC (3.6ºF) over the last few decades, and the largest bodies of multi-year ice have all been declining faster since 2000 compared to the previous decade. [Related items: *Arctic Dialogue* in September 2010 and other previous reports.]

**Military Implications:**

Military personnel associated with the Arctic should enhance cooperation with counterparts among the Arctic Council States in designing rescue operation strategies as per the new Accord.

**Sources:**

Arctic Council Ministers Sign Agreement in Nuuk
http://arctic-council.org/article/2011/5/arctic_council_ministers_sign_agreement
Warming Arctic Nations Agree on Search and Rescue, Oil Spill Task Force
http://www.ens-newswire.com/ens/may2011/2011-05-12-03.html

### 8.9 Climate Change

8.9.1 Scientific Evidence and Natural Disasters

The Center for Research for Epidemiology of Disasters notes that disasters have already caused more than $300 billion in losses so far this year, almost the same as in all of 2010.

NOAA predicts with a 70% probability an above-normal hurricane season this year for the Atlantic basin, with 3-6 major hurricanes of Category 3, 4 or 5 with winds of 111 miles per hour or higher.

### 8.9.2 Food and Water Security

One-third of the food produced for human consumption in the world each year is lost or wasted, with consumers in rich countries wasting about 222 million metric tons of food—about the same as the entire net food production of sub-Saharan Africa, notes the study *Global Food Losses and Food Waste*, done at FAO's request. While in industrialized countries over 40% of losses occur at retail and consumer levels, in developing countries 40% of losses occur at post-harvest and processing levels.

The UNDP Regional Director for Asia and Pacific noted that the recent food price increase could push 64 million people into extreme poverty and the challenge could be further compounded by climate change and other natural disasters.

The Samsung Economic Research Institute report *New Food Security Strategies in the Age of Global Food Crises* calls for the South Korean government to secure foreign bases for food production through overseas agricultural development. Today, some 60 South Korean companies are involved in farming in 16 countries. Simultaneously, the China Investment Corporation, China's sovereign wealth fund, reportedly set aside about $6 billion to invest in New Zealand assets, including dairy farms.

India, home of about 25% of the world's undernourished, proposes a draft National Food Security Bill which guarantees 7 kg of food grain to every person in the 'priority' households (to be selected from the poorest 46% in rural areas and 26% in urban areas) and 3 kg to individuals from 'general' households every month at subsidized prices. The bill is also unique in giving adult women heads of household access to rice, wheat and cereals with ration cards.

British risk analysis firm Maplecroft has recently released their *2011 Water Stress Index*, which calculates the ratio of domestic, industrial and agricultural water consumption against renewable supplies of water from precipitation, rivers, and groundwater. The results reinforce that Africa and the Middle East, especially those countries on the Persian-Arabian Gulf, are most vulnerable to serious water shortages, increasing the likelihood of resource-based conflicts in these areas.

### 8.9.3 Rising Sea Levels

A new report by the Arctic Monitoring and Assessment Programme predicts that by 2100, sea level could rise 0.9-1.6 meters, much depending on the rate of melting of the Arctic and Greenland's ice sheets.

### 8.9.4 Adaptation

Over 2,600 delegates attended the Third Session of the Global Platform for Disaster Risk Reduction (DRR) held May 9-13, 2011, in Geneva, Switzerland, under the theme "Invest Today for a Safer Tomorrow." The UN *Global Assessment Report on Disaster Risk Reduction 2011*, launched during the session, notes that the amount of global wealth exposed to natural disasters risk had nearly tripled from $525.7 billion 40 years ago to $1.58 trillion today. The risk of economic losses in OECD countries due to floods has increased by 160% and for tropical

cyclones by 262% over the past 30 years. During the session, the Danish Ministry of Foreign Affairs noted that for every $1 invested in resilience and prevention, $4-$7 are saved in response.

8.9.5 Computer Modeling and Projections

Population Action International launched an interactive website, "Mapping Population and Climate Change," which allows users to generate maps using a variety of variables to see how global challenges such as climate change, population growth, water scarcity, and changes in agricultural production might relate over time.

**Military and Security Implications:**

[Same as previous on this issue] The military should identify all its resources and programs for reducing GHGs and responding to effects of climate change, update information continuously, forecast how it might be called upon for both mitigation and adaptation, and perform a gap analysis in anticipation of future requests. International discourse over climate change is increasing the development of international policies and strategies to mitigate and adapt to climate change.

**Sources:** (see an expanded list in the Appendix)

Economic losses from disasters on rise, U.N. warns
http://www.reuters.com/article/2011/05/10/disasters-un-idUSLDE7481R520110510
NOAA: Prepare Now for an 'Above-Normal' Atlantic Hurricane Season
http://www.ens-newswire.com/ens/may2011/2011-05-25-093.html
Cutting food waste to feed the world. Over a billion tonnes squandered each year
http://www.fao.org/news/story/en/item/74192/icode/
South Korea's food security alarm
http://farmlandgrab.org/post/view/18525
China's sovereign wealth fund ready to spend $6b in NZ:
http://farmlandgrab.org/post/view/18675
Food security related statistics for India
http://palakmathur.wordpress.com/2011/04/26/food-security-related-statistics-for-india/
Maplecroft index identifies Bahrain, Qatar, Kuwait and Saudi Arabia as world's most water stressed countries
http://www.maplecroft.com/about/news/water_stress_index.html
Report sees sharper sea rise from Arctic melt
http://news.yahoo.com/s/ap/20110503/ap_on_sc/eu_arctic_climate_change
Global Platform Website
http://www.preventionweb.net/globalplatform/2011/
*Global Assessment Report on Disaster Risk Reduction 2011*
http://www.preventionweb.net/english/hyogo/gar/2011/en/home/index.html
Mapping Population and Climate Change
http://www.populationaction.org/Publications/Interactive_Databases/climate_map.shtml

### 8.10 Nanotechnology Safety Issues

More detailed descriptions of the following nanotechnology issues are in the Appendix

- ISO published ISO/TR 13121:2011 Nanomaterial risk evaluation (more)
- EPA is issuing a significant new use rule (SNUR), under the Toxic Substances Control Act, for multi-walled carbon nanotubes (more)

- UCSF publication of *Recommendations for Addressing Potential Health Risks from Nanomaterials in California* (more)
- EU Food Safety Authority publishes guidance for risk assessment of nanofood (more)
- Dutch safety guidance document for nanomaterials workers (more)
- OECD Review of the safety of manufactured nanomaterials (more)
- Confirmed harmful effects on plants of $TiO_2$ and ZnO nanoparticles in the soil (more)
- Studies raise questions on nanomaterial manufacturing reliability (more)
- *Assessing Nanoparticle Risks to Human Health* report (more)
- 5th International Nano Authorities Dialogue held in Berlin (more)

## Item 9. Reports and Information Suggested for Review

### 9.1 2011 Global Peace Index

The Global Peace Index uses 23 indicators to measure domestic and international conflict, safety and security in society, and militarization in 153 countries. The 2011 GPI shows the world's peacefulness decreased for the third year in a row, mostly due to internal unrests rather than warfare between countries; the increase of likelihood of terrorist attacks increased in 29 of the 153 countries; and violent demonstrations increased in 33 countries. The cost of violence to the global economy is estimated to over $8.12 trillion in 2010.

**Military Implications:**
Military personnel involved in social stability assessments should review this report for comparisons with their own assessments. Also, comparing the Global Peace Index of countries with the Environmental Vulnerability Index [see January 2010 report] could provide important environmental security information for setting priorities and appropriate actions.

**Sources:**
2011 Global Peace Index
http://www.visionofhumanity.org/info-center/global-peace-index-2011/
2011 Global Peace Index Launch
http://www.economicsandpeace.org/page.aspx?docid=5

### 9.2 Transnational Environmental Law (TEL)

The *Transnational Environmental Law* (TEL) journal published by Cambridge University Press is being launched with the online version of the first issue expected at the end of 2011, to be followed by its print publication in Spring 2012. TEL, "is a peer-reviewed journal dedicated to the study of environmental law and governance beyond the state."

**Military Implications:**
Relevant military personnel should consider the journal as a source of information on the evolution of environmental law in a global context.

**Source:**
*Transnational Environmental Law* (TEL)
http://journals.cambridge.org/action/displayJournal?jid=TEL

## APPENDIX

### Reference Details

This Appendix contains expanded background information on some items.

## Item 8. Updates on Previously Identified Issues

### Item 8.1. International Nuclear Safety Regulations to be Strengthened and Enforced

**Sources:** (an expanded list)
Fukushima: How Many Chernobyls Is It?
http://www.veteranstoday.com/2011/05/28/fukushima-how-many-chernobyls-is-it/
Germany nuclear shutdown by 2022 may mean blackouts, Merkel warned
http://www.guardian.co.uk/environment/2011/may/23/germany-nuclear-shutdown-winter-blackouts
'End the Epoch of Atomic Madness' in the EU
http://www.spiegel.de/international/germany/0,1518,765066,00.html
Japan sets up independent panel probing Fukushima crisis
http://mdn.mainichi.jp/mdnnews/news/20110524p2g00m0dm070000c.html
U.N. body to probe Fukushima radiation impact
http://www.reuters.com/article/2011/05/23/us-japan-fukushima-un-idUSTRE74M3VT20110523
G8 Leaders Want Tougher Nuclear Safety Rule
http://planetark.org/wen/62136
U.N. Chief Calls For Nuclear Safety Boost
http://planetark.org/wen/61972
Leak From Japan Reactor 100 Times More Than Permitted
http://planetark.org/wen/62101
Germany's Merkel backs nuclear exit within a decade
http://www.reuters.com/article/2011/05/21/us-germany-nuclear-idUSTRE74K2AL20110521
Radioactive Fluid Released at Japan Plant
http://gsn.nti.org/gsn/nw_20110526_9958.php
Tepco confirms meltdowns at 2 more Fukushima reactors
http://www.reuters.com/article/2011/05/24/us-japan-tepco-reactors-idUSTRE74N07S20110524

### 8.5 New Developments for Strengthening Cybersecurity

**Sources:** (expanded list)
EU Institutions to Create New Cyber Defense Unit
http://euobserver.com/18/32368
Sarkozy prioritises internet regulation at G8 summit – Telegraph
http://www.cyber-defense.net/news/sarkozy-prioritises-internet-regulation-at-g8-summit-telegraph/
Plan Calls for More Cybersecurity
http://www.treasuryandrisk.com/2011/05/13/plan-calls-for-more-cybersecurity

White House Affirms US and UK Cybersecurity Cooperation
http://blogs.technet.com/b/security/archive/2011/05/26/white-house-affirms-us-and-uk-cybersecurity-cooperation.aspx
India, US affirm strategic importance of cooperation against terror
http://netindian.in/news/2011/05/27/00013461/india-us-affirm-strategic-importance-cooperation-against-terror
Defense Minister Proposes Nordic-Baltic Cyber Force
http://news.err.ee/politics/bd766f96-444c-43a6-acfa-edb53924a0b6
Minister Urges Stronger Cyber Security Measures in Iranian Organizations
http://english.farsnews.com/newstext.php?nn=9003071319

### 8.9 Climate Change

**Sources:** (expanded list)

8.9.1 Scientific Evidence and Natural Disasters
Economic losses from disasters on rise, U.N. warns
http://www.reuters.com/article/2011/05/10/disasters-un-idUSLDE7481R520110510
NOAA: Prepare Now for an 'Above-Normal' Atlantic Hurricane Season
http://www.ens-newswire.com/ens/may2011/2011-05-25-093.html
Inland Storms, Growing in Violence, Drive Insurers to Accept Riskier Reality
http://www.nytimes.com/cwire/2011/05/20/20climatewire-inland-storms-growing-in-violence-drive-insu-96465.html?ref=earth

8.9.2 Food and Water Security
Cutting food waste to feed the world. Over a billion tonnes squandered each year
http://www.fao.org/news/story/en/item/74192/icode/
Water Shortages Threaten Food Future in the Arab Middle East
http://www.earth-policy.org/plan_b_updates/2011/update95
Water Disputes In South Asia: Can Region Come Together? – Analysis
http://www.eurasiareview.com/water-disputes-in-south-asia-can-region-come-together-analysis-09052011/
Chhibber: Poorest countries need help to build up their resilience: http://content.undp.org/go/newsroom/2011/may/ajay-chhibber-poorest-countries-need-help-to-build-up-their-resilience.en;jsessionid=agkzKNN_5WY-
Food Security Main Threat Facing Asean, SBY Warns: http://www.thejakartaglobe.com/business/food-security-main-threat-facing-asean-sby-warns/439907
South Korea's food security alarm
http://farmlandgrab.org/post/view/18525
China's sovereign wealth fund ready to spend $6b in NZ:
http://farmlandgrab.org/post/view/18675
Food Security Bill: Women made heads of households selected for food grain distribution:
http://economictimes.indiatimes.com/news/economy/policy/food-security-bill-women-made-heads-of-households-selected-for-food-grain-distribution/articleshow/8631254.cms
Food security related statistics for India: http://palakmathur.wordpress.com/2011/04/26/food-security-related-statistics-for-india/

Maplecroft index identifies Bahrain, Qatar, Kuwait and Saudi Arabia as world's most water stressed countries
http://www.maplecroft.com/about/news/water_stress_index.html

8.9.3 Rising Sea Levels
Report sees sharper sea rise from Arctic melt
http://news.yahoo.com/s/ap/20110503/ap_on_sc/eu_arctic_climate_change
Statement by Andrew Steer, Special Envoy for Climate Change, World Bank Group on new Report by the Arctic Monitoring and Assessment Program
http://web.worldbank.org/WBSITE/EXTERNAL/NEWS/0,,contentMDK:22905780~menuPK:51062077~pagePK:34370~piPK:34424~theSitePK:4607,00.html

8.9.4 Adaptation
Global Platform Website
http://www.preventionweb.net/globalplatform/2011/
Third Session of the Global Platform for Disaster Risk Reduction Chair's summary
http://www.preventionweb.net/files/20102_chairsummarythirdsessionglobalplatf.pdf
IISD coverage of the Third Session of the Global Platform for Disaster Risk Reduction
http://www.iisd.ca/ymb/gpdrr/2011/
*Global Assessment Report on Disaster Risk Reduction 2011*
http://www.preventionweb.net/english/hyogo/gar/2011/en/home/index.html

8.9.5 Computer Modeling and Scenarios
Mapping Population and Climate Change
http://www.populationaction.org/Publications/Interactive_Databases/climate_map.shtml

**8.10 Nanotechnology Safety Issues**
More detailed descriptions of the nanotechnology issues

8.10.1 ISO Publishes Standard for Nanomaterial Risk Evaluation
The International Organization for Standardization has published *ISO/TR 13121:2011 Nanomaterial risk evaluation* (58 pp.). It "describes a process for identifying, evaluating, addressing, making decisions about, and communicating the potential risks of developing and using manufactured nanomaterials", as well as offering guidance on how to handle the problems of uncertain information, updating and communicating information, and transparency and accountability.

**Military Implications:**
All military personnel concerned with nanotech risk evaluation should review this work, for recommendations, carefully thought out by the international community, on how to carry out that process.

**Sources:**
ISO/TR 13121:2011 Nanotechnologies -- Nanomaterial risk evaluation
http://www.iso.org/iso/catalogue_detail.htm?csnumber=52976&utm_source=ISO&utm_medium=RSS&utm_campaign=Catalogue
ISO Publishes Standard for Nanomaterial Risk Evaluation
http://nanotech.lawbc.com/2011/05/articles/legalregulatory-issues/iso-publishes-standard-for-nanomaterial-risk-evaluation/

8.10.2 EPA Issues Significant New Use Rule for Multi-Walled Carbon Nanotubes
EPA is issuing a significant new use rule (SNUR), under the Toxic Substances Control Act, for multi-walled carbon nanotubes, the subject of a premanufacture notice (PMN) P-08-199. It requires their manufacture, import, or processing to be notified to the Agency in advance.

**Military Implications:**
Organizations dealing with these nanomaterials should ensure that activities under their supervision comply with this rule.

**Sources:**
SNUR under the Toxic Substances Control Act
http://www.gpo.gov/fdsys/pkg/FR-2011-05-06/pdf/2011-11127.pdf
EPA issues a significant new use rule for multi-walled carbon nanotubes
http://www.nanowerk.com/news/newsid=21263.php

8.10.3 UCSF Publishes Recommendations for Addressing Nanomaterial Health Risk
The University of California, San Francisco's (UCSF) Program on Reproductive Health and the Environment has announced the publication of its Recommendations for Addressing Potential Health Risks from Nanomaterials in California. It provides recommendations to the Office of Environmental Health Hazard Assessment (OEHHA) and to the state of California for addressing potential health risks from nanomaterials. Recommendations are included that are both inside and outside the scope of OEHHA

**Military Implications:**
Personnel concerned with nanoregulation should review this publication for insights into possible future regulatory measures in U.S. jurisdictions everywhere.

**Sources:**
Summary of Policy Recommendations for Addressing Potential Health Risks from Nanomaterials in California
http://prhe.ucsf.edu/prhe/nanodocument.html
UCSF's Program on Reproductive Health and the Environment Publishes Recommendations for Addressing Health Risks from Nanomaterials in California
http://nanotech.lawbc.com/2011/05/articles/united-states/state/ucsfs-program-on-reproductive-health-and-the-environment-publishes-recommendations-for-addressing-health-risks-from-nanomaterials-in-california/

8.10.4 EU Food Safety Authority Publishes Guidance for Risk Assessment of Nanofood
The European Food Safety Authority (EFSA) has published a guidance document for the risk assessment of engineered nanomaterial (ENM) applications in food and feed. According to

Nanowerk News, it specifies the considerations for risk assessment of ENM, defines the additional data needed for its physical and chemical characterization, and outlines various toxicity testing approaches to be followed by applicants.

**Military Implications:**
Military personnel involved with ENM risk assessment should review this document for its suggestions on how that function should be carried out. (See related item 11.5.7 UK Food Safety Organization Calls for Increased Nanomaterial Vigilance in the March 2011 issue of this report.)

**Sources:**
Guidance on the risk assessment of the application of nanoscience and nanotechnologies in the food and feed chain
http://www.efsa.europa.eu/en/efsajournal/doc/2140.pdf
European Food Safety Authority publishes nanotechnology guidance for food and feed assessment
http://www.nanowerk.com/news/newsid=21308.php

8.10.5 New Dutch Safety Guidance Document for Nanomaterials Workers

The Dutch Ministry of Social Affairs and Employment has released a new document (17 pp.), *Guidance on Working Safely with Nanomaterials and Nanoproducts, the Guide for Employers and Employees*. It attempts to support workers "in their design of suitable control measures to organize a safe workplace according to the current state of knowledge on health and safety issues of nanomaterials" and aims for "more general awareness raising on nano-risks".

**Military Implications:**
Personnel working on nanomaterial risk issues should review this document for useful ideas.

**Sources:**
Guidance Working Safely With Nanomaterials and Nanoproducts. The Guide for Employers and Employees
http://www.industox.nl/Guidance%20on%20safe%20handling%20nanomats&products.pdf
New safety guidance document for employers and employees working with nanomaterials
http://www.nanowerk.com/news/newsid=21454.php

8.10.6 OECD Review of the Safety of Manufactured Nanomaterials

According to *Nanowerk News*, the OECD's new *Current Developments/Activities on the Safety of Manufactured Nanomaterials* provides a summary of information on current and planned activities related to the safety of manufactured nanomaterials in OECD member countries as well as other states. There are also reports on current activities from other international organizations such as ISO, FAO and WHO.

**Military Implications:**
Personnel concerned with nanomaterial risk evaluation should consider reviewing the OECD report for inputs on planned activities related to the safety of manufactured nanomaterials.

**Sources:**
OECD review: Current developments/activities on the safety of manufactured nanomaterials
http://www.nanowerk.com/news/newsid=21512.php

Environment Directorate Joint Meeting of the Chemicals Committee and the Working Party on Chemicals, Pesticides and Biotechnology
http://www.oecd.org/officialdocuments/displaydocumentpdf/?cote=env/jm/mono%282011%2912&doclanguage=en

8.10.7 Some Confirmation of Deleterious Effects of Soil Nanoparticles

A field study by scientists of the Chinese Academy of Sciences has confirmed the predicted harmful effects on plants of $TiO_2$ and ZnO nanoparticles in the soil. The biomass of wheat was reduced 7-13%, and the particles appeared in the plant growth. No final conclusions can be drawn from the study, however, since the concentrations of the particles in the soil were higher than would be encountered in real nanomaterial usage, aside from an environmental spill. [Related item: *Silver Nanoparticles Found Very Toxic to Arctic Soils* in the April 2011 report.]

**Military Implications:**

These results should be taken into consideration in the overall process of evaluating nanoparticle risks.

**Sources:**

$TiO_2$ and ZnO nanoparticles negatively affect wheat growth and soil enzyme activities in agricultural soil
http://pubs.rsc.org/en/content/articlelanding/2011/em/c0em00611d
Escaped nanoparticles hazardous to crops, says study
http://www.scidev.net/en/news/escaped-nanoparticles-hazardous-to-crops-says-study.html

8.10.8 Studies Raise Questions on Nanomaterial Manufacturing Reliability

A brief article summarizes various studies that are raising questions about the ability of current nanomaterial manufacturing processes to reliably produce materials with specified physical and chemical characteristics; i.e., those needed for environmental safety. The problem arises because of the use of "macro-sized" methods to produce “nano-sized” components.

**Military Implications:**

Personnel concerned with nanomaterial risk evaluation should consider reviewing this article.

**Sources:**

Nanotech industry comes under fire
http://physicsworld.com/cws/article/news/45929
Intrinsic top-down unmanufacturability
http://iopscience.iop.org/0957-4484/22/24/245303/

8.10.9 Assessing Nanoparticle Risks to Human Health

*Assessing Nanoparticle Risks to Human Health* to be published by RESEARCHANDMARKETS provides a systematic look at nanoparticle risks within the paradigm of risk assessment, considers the limitations of this paradigm in dealing with the extreme uncertainties regarding many aspects of nanoparticle exposure and toxicity, and suggests new methods for assessing and managing risks in this context. The book is available at an introductory reduced price before its planned release in September.

**Military Implications:**
Personnel concerned with nanomaterial risk evaluation should consider reviewing this book.

**Source:**
Assessing Nanoparticle Risks to Human Health
http://www.researchandmarkets.com/product/5b558f79/assessing_nanoparticle_risks_to_human_health

8.10.10 5th International Nano Authorities Dialogue Held in Berlin
This meeting among representatives of German-speaking countries was held to discuss the results of NanoKommission Germany 2009-2011 as well as ongoing national and international developments in regulation, registration, and information transfer regarding nanomaterials. Topics mentioned in the brief released account of the meeting included regulatory tools, stakeholder dialogue, and product registers.

**Military Implications:**
The published account of the meeting should be reviewed for insights into the participants' views on regulation and information dissemination.

**Source:**
Information Transfer, Traceability and Product Registers for Nanoproducts – 5th Int. Nano Authorities Dialogue in Berlin
http://www.innovationsgesellschaft.ch/index.php?section=news&cmd=details&newsid=469&teaserId=7&setLang=2