

## Non-lethal Weapons: The Environmental Issues

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Non-lethal weapons are neither new in concept nor in practical use. Most are physical and very spatially limited in effect, airborne gases notwithstanding. However, some newer ones in development and entering use can become dispersed in the environment during training and actual use. Among these are microtechnology sensors/transmitters/actors, slippery sliming agents, sticking agents, entangling agents, corrosive agents, intense acoustics and intense light. These items and substances can be highly effective in constraining opponents' physical mobility, control of body function and coordination, mood and persistence, and command and control arrangements. Unless development, training and deployment managers attend to associated environmental issues, both political and scientific, these control tools could be withheld from application.

Some of the chemical style agents are meant to be used locally, with the assumption that they will disperse in air or water as the method of disposal. It is not yet clear what effects the various chemicals will have on air, soil, water, biota, or waste water treatment effectiveness. Pollution Prevention analysis has begun, but not consistently for all proposed systems.

One is also faced with closely related issues of protecting one's own personnel who

might be in intimate contact with chemical constituents or end-products of non-lethal weapons. One-time and rare uses may not be important with respect to exposure and hazard compared to the benefits of real time application, but repeated use and contact may be another matter. Chronic effects, such as carcinogenicity, may be more important than immediate effects and must be carefully considered in long-term studies.

The questions explicitly and implicitly raised above can be addressed in advance of the use of these weapons, in order to ensure that new cases of contaminated lands, waters and living species will not be created. Military exercise managers will increasingly need to employ non-lethal weapons in training in order to maximize soldiers' effectiveness for a wide range of applications. Knowledge of and preparedness for negative environmental side-effects will minimize: damage to training areas that would reduce their future training usefulness, costs of maintenance or eventual site remediation, and exposure to political attack on the basis of being insensitive to environmental stewardship.

The US Marine Corps has instituted physical capture of rubber stinging balls on firing ranges to prevent ingestion by wildlife. Still, evaluation and development of management strategies need to be accomplished for the less obvious environmental impacts of more complex non-lethal weapons. NATO announced (Reuters 26 Oct 99) intentions to acquire and use non-lethal weapons. Recent experiences in the former

Yugoslavia highlighted opportunities to achieve protection and separation roles with less than deadly force tactics. Thus, NATO members will undoubtedly have to design training programs and facilities with new features in order to avoid generating new environmental damages while preparing for NATO missions. The same is true for civilian police organizations that might employ non-lethal weapons.

What, for instance, are some of these plausible environmental hazards? Table 1 suggests typical ways in which non-lethal weapons might negatively impact the environment, users, and targets.

Management options include research on environmental impacts, research and development on impact minimization, contingency coordination with environmental management authorities, evaluation of local and international attitudes, and training facility design and operation considerations. Early, deliberate attention to preventing or minimizing the health, environmental, and political issues discussed above is vital.

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**Table 1.** Potential impacts of non-lethal weapons

Non-lethal Weapon	Application	Worst Case Environmental & Occupational Health Impacts
Acoustics—intense —coherent	Disorientation; initiate vomiting Communication	<ul style="list-style-type: none"> <li>• Permanent harm to susceptible aged, infants or ill persons.</li> <li>• Wildlife eating &amp; mating disturbance.</li> <li>• Same for domestic animals in range of effects.</li> </ul>
Corrosive agents	Nullify/disrupt functions of weapon, communication and transportation hardware items	<ul style="list-style-type: none"> <li>• Water body degradation: general water pollution, wildlife toxicity, direct human clinical or chronic toxicity, carcinogenicity.</li> <li>• Accumulation on training ranges, in water, in soil.</li> <li>• Discharge to streams/lakes if flushed to cleanse training facility or area of operations.</li> </ul>
Electroshock (solid or liquid conductor)	Group disorder, individual disorientation & incapacitation	<ul style="list-style-type: none"> <li>• Permanent harm to susceptible aged, infants or ill persons.</li> <li>• Water body degradation: general water pollution, wildlife toxicity, direct human clinical or chronic toxicity, depending on the electrolyte used in liquid conductors.</li> <li>• Wildlife death, if entangled in abandoned wires.</li> <li>• Electrolyte accumulation on ranges, in water, in soil.</li> </ul>
Entangling agents/nets	Individual/crowd immobilizing, momentum breaking	<ul style="list-style-type: none"> <li>• Death of wildlife, if monofilaments left on training ranges.</li> </ul>
Light—intense	Disorientation, incapacitation	<ul style="list-style-type: none"> <li>• Potential for permanent vision impairment.</li> <li>• Permanent harm to susceptible aged, infants or ill persons.</li> <li>• Wildlife eating &amp; mating disturbance.</li> <li>• Same for domestic animals in zone of effects.</li> </ul>
Marker dyes	Mark for recognition	<ul style="list-style-type: none"> <li>• Water body degradation: general water pollution, wildlife toxicity, direct human clinical or chronic toxicity, &amp; carcinogenicity.</li> <li>• Accumulation on ranges, in water, in soil.</li> <li>• Discharge to streams/lakes if flushed to cleanse training facilities or areas of actual use.</li> </ul>
Micro-technology (=Nano-technology)	Locating, tracking, communications	<ul style="list-style-type: none"> <li>• Human &amp; wildlife ingestion: lung damage, toxicity in gut.</li> <li>• Accumulation on training ranges, in water, &amp; in soil.</li> </ul>
Microwave radiation	Body heating for inducing discomfort or disorientation	<ul style="list-style-type: none"> <li>• Potential for permanent impairment.</li> <li>• Permanent harm to susceptible aged, infants or ill persons.</li> <li>• Wildlife disturbance/death on training facilities or in operations.</li> <li>• Same for domestic animals in zone of effects.</li> </ul>
Slippery/sliming agents	Crowd immobilizing, momentum breaking	<ul style="list-style-type: none"> <li>• Water body degradation: general water pollution, wildlife toxicity, direct human clinical or chronic toxicity, carcinogenicity.</li> <li>• Accumulation on training ranges, in water, in soil.</li> <li>• Discharge to streams/lakes if flushed to cleanse training facilities or areas of operation.</li> </ul>
Sticking agents	Individual/crowd immobilizing, momentum breaking	<ul style="list-style-type: none"> <li>• Water body degradation: general water pollution, wildlife toxicity, direct human clinical or chronic toxicity, carcinogenicity.</li> <li>• Accumulation on training ranges, in water, in soil.</li> <li>• Pollution by discharge to streams/lakes if flushed to cleanse training facilities or areas of operation.</li> </ul>