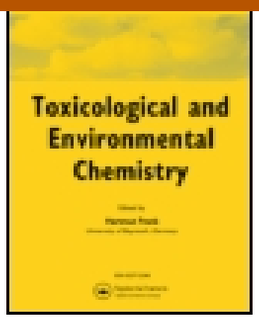

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Chemical Weapons: What is the Purpose?
The Hague Ethical Guidelines

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Terror! Chemical weapons cause harm in a most un-selective manner, a silent threat bringing death through painful struggle, indiscriminately injuring and killing combatants and civilians alike, without destroying buildings and infrastructure - and terrorizing those who have survived.

The very existence of weaponized chemicals requires the knowledge of chemistry, making them a blight on chemists, on the chemical profession, and the chemical industry. Imagine a day when chemists, along with other scientists such as physicists, toxicologists and (chemical) engineers whose skill sets might also be exploited for developing chemical weapons, vow not to participate in activities related to developing new weapons of war; like in Sandburg's ([1936] 1990) poem *The People, Yes*: *Sometime they'll give a war and nobody will come*. Such a stance might sound naïve, yet to shrug shoulders and denounce any involvement and responsibility is at the least perfunctory. Chemists have invented explosives, incendiaries, defoliants, and chemicals that attack skin and lungs; have helped to develop technologies to deploy such chemicals; and created the industries capable of producing these chemicals on a large scale. Like Oppenheimer and Einstein, some physicists have reflected on the dichotomy of progress in nuclear physics leading to atomic bombs on Hiroshima and Nagasaki, as chemists have mourned their problematic involvement in the development of ever more deadly weapons, like Alfred Nobel, the inventor of dynamite, in his letter exchange with Berta von Suttner. But other eminent members of the chemical profession have neglected their personal responsibility, for example Chemistry Nobel Laureate Fritz Haber, a protagonist of the use of corrosive volatile chemicals as warfare agents and the first to personally deploy them on a large scale (e.g. Gal 2015); or Chemistry Nobel Laureate Richard Kuhn who helped in "perfecting" the neuro-

toxicity of the organophosphate nerve agents (Schmaltz 2005, 480-510), accidentally discovered by Gerhard Schrader in search for effective pesticides (Pfingsten 2003); or the famous chemist and textbook author Louis Fieser who painstakingly optimized napalm in order to make it stick better to human skin where it could continue to burn (Koch 2016).

These are examples of how scientists, deliberately or involuntarily like Schrader, can become entangled in a cobweb of political pressures, economic interests, and professional ambition. These examples raise questions on whether chemistry professionals are free of responsibility for their inventions. Can they neglect thoughts about the consequences of their work? In a manner similar to addressing the impact of chemicals for environmental protection through REACH regulations and engaging with relevant stakeholders (including practitioners of chemistry and those outside the sciences that rely on the chemical industry for economic and societal benefit), is there a need to more actively address the same questions for the protection of humans, in particular how abuse of science for development of weapons can be minimized? Fortunately, awareness of this need is growing amongst professional communities, many organisations of relevance to chemistry have issued codes of ethics and conduct,[1] and there are a number of recent initiatives bringing more visibility to these issues. The Organization for the Prohibition of Chemical Weapons (OPCW) upon the initiative of the German ambassador to the Chemical Weapons Convention has encouraged chemistry practitioners to formulate a set of Ethical Guidelines (The Hague Ethical Guidelines) (Husbands and Suarez 2016)[2]); the European Association for the Chemical and Molecular Sciences (EuCheMS) has established a "Working Party on Ethics in Chemistry" discussing how to implement an educational module on applied ethics in university curricula for chemistry students; and the American Chemical Society (ACS) has recognized the OPCW for its promotion of peaceful uses of chemistry[3] and facilitated the drafting of a Global Chemists Code of Ethics using The Hague Ethical Guidelines as a starting point[4].

Applied ethics in chemistry is still a "fuzzy" subject of trans-disciplinary nature, but there is great need in promoting and developing ethical concepts in the practice of chemistry. Familiar examples include ethical considerations on to how to conduct research honestly and to publish it with due recognition of previous workers and present contributors; and how to avoid health risks to people who may involuntarily or unknowingly be exposed to chemicals. In this context, one is reminded of the Hippocratic Oath emphasizing the importance of honesty and empathy to the patient; an analogous vow could be developed for practitioners of the chemical sciences

There are no clear-cut answers, but professionals active in chemistry and associated sciences must engage and communicate with those outside their professional circles in order to be accepted as trustworthy by the general public (Sarewitz 2016). In the end, building such trust will be beneficial to the chemical profession at large as well as science as a whole; for how else can we ensure that the benefits of science and its inputs for solving global problems make their way into the considerations

[1] See for example the collection of codes compiled during The Hague Ethical Guidelines project. Available at https://www.opcw.org/fileadmin/OPCW/SAB/en/2015_Compilation_of_Chemistry_Codes.pdf.
[2] For more information see https://www.opcw.org/special-sections/science-technology/the-hague-ethical-guidelines/.
[3] For more information see https://www.acs.org/content/acs/en/pressroom/newsreleases/2015/march/acs-recognizes-organisation-for-the-prohibition-of-chemical-weapons.html.
[4] For more information see https://www.acs.org/content/acs/en/global/international/regional/eventsglobal/global-chemists-code-of-ethics.html.

of decision makers. Demonstrating a commitment to responsible scientific practices and upholding ethical norms and humane values are the foundation on which the trust is built. The Age of Enlightenment established the root of science as we know it today, and at the same time was the historical stage when the balance of individual freedom and responsibility within its societal context was re-thought to result in the consideration of human rights; this quest for finding the proper balance is an evolving process that must be nurtured and discussed. To practice science irresponsibly risks the freedom that is often taken for granted in scientific pursuits..

The OPCW has succeeded in persuading 192[5] of the world's 196 internationally recognized nations to become States Parties to the *Chemical Weapons Convention,* committing to abandon the use, production and storage of chemical weapons. Only Egypt, Israel, the Democratic Peoples Republic of Korea, and South Sudan remain outside the Convention, but even with this heartening progress we see continued allegations of chemical weapons being used in Syria. In some cases chemicals such as chlorine, which have legitimate application in e.g. water purification, have been hijacked for improper use, in others even banned substances such as sarin have been deployed (Fischer *et al.* 2016). Complete removal of the scourge of chemical weapons will not be achieved only by destroying the existing ones but also by embracing values that encourage and enable scientists to resist getting involved in the production of new ones. This is a challenge for all of us in the chemistry profession, a challenge that requires bringing humane values into our professional development!

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[5] For a list of States Parties to the Chemical Weapons Convention, see https://www.opcw.org/about-opcw/member-states/