Part II
Contexts and Consequences of Chemical Weapons

The Gas War, 1915–1918: If not a War Winner, Hardly a Failure

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Abstract Contemporary claims that gas warfare proved "a failure" during the First World War would have baffled wartime adversaries, who invested heavily in the research, development, and production of gas warfare. If poison gas, like other conventional weapons, never broke the stalemate of the trenches, it evolved into a weapon of harassment that compounded the effects of conventional weapons and degraded the effectiveness of enemy forces compelled to wear gas masks for protracted periods of time. The introduction of mustard gas in July 1917 greatly increased the number of gas casualties, and set the scene for a steady increase in the use of chemical weapons during the later stages of the war. Like the tank and aircraft, gas was not strategically decisive, but continuing investment in this form of warfare underscored its potential utility.

1 Introduction

The onset of chemical warfare in the First World War produced not only major scientific, industrial, and military challenges to the principal belligerents but also a legacy that has been fiercely debated. After the first major use of chlorine gas by German forces, when they dispersed chlorine from 5,730 cylinders along a 6-km front at Ypres on April 22, 1915 (McWilliams and Steel 1985, Chaps. 5 and 6), the gas war expanded prodigiously as the main belligerents introduced new and more potent gases and sought to deliver them more efficiently. Although the French and Germans had used irritant agents before April 22 (Trumpener 1975, 461–465), they later employed lethal agents such as chlorine, phosgene, and, above all, mustard gas as the primary instruments of gas warfare. Like the British, they enhanced their methods of gas protection, and dispersed gas by various means, including cylinders,

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B. Friedrich et al. (eds.), *One Hundred Years of Chemical Warfare: Research, Deployment, Consequences*, DOI 10.1007/978-3-319-51664-6_9

mortars, projectors, and gas shells. The gas war, argued Major Victor Lefebure, became "one of continual attempts on both sides to achieve surprise and to counter it by some accurate forecast in protective methods. It is a struggle for the initiative" (Lefebure 1921, 109–110).

2 Debate

Assessing the significance of this struggle has produced a wide array of judgments. The allies, eying the response in neutral United States (Peterson 1939, 63; Read 1941, 195–199), denounced the first use of chlorine gas as "an atrocious method of warfare" which would "fill all races with a new horror of the German name" (*The Times*, April 29, 1915). Nevertheless, when they retaliated in kind, a reaction described "as just and necessary" (Brown 1968, 15), they did so without analyzing its effectiveness. Only at the end of the war were several British and American gas officers able to comment on the impact of chemical warfare. Major Samuel J. M. Auld, a former Chemical Advisor, British Third Army, argued that "the use of poisonous and irritating gases is as fundamental as the introduction of gunpowder, and probably even more so," and he extolled the effects of mustard gas during the last year of the war (Auld 1922, 58, 66). Amos A. Fries, an American engineer, who became Chief of the Chemical Warfare Service, described gas as "one of the most powerful means of offense with which the American troops had to contend" (Fries and West 1921, 386). Major-General Charles H. Foulkes, the former British Director of Gas Services (1917–18), insisted that gas had "changed the whole *character* of warfare." Gas, he observed, had seriously affected German morale during the last months of 1918, contributing "to the Allied victory": it was of "increasing" importance towards the end of the war, and "might have played a decisive part in 1919" (Foulkes 1936, 334, 336, 345). Brigadier-General Harold Hartley, a future Fellow of the Royal Society, claimed, too, that "gas is a very valuable weapon, as it supplements other weapons, offers great opportunities for surprise, and is a most effective means of achieving many tactical objects" (Hartley 1919–20, 504).

Revisionism followed the Second World War, a conflict in which poison gas was stockpiled massively but not used between the principal adversaries in Europe, in contrast to the Pacific Theater where the Imperial Japanese Army used chemical weapons from 1937 onwards in occupied China. In his final volume of the official history of the Great War, produced in 1947, Brigadier J. E. Edmonds contradicted much of his earlier writing (Edmonds et al. 1937, vol. 2, 163–164, 383, 390, 412) by observing that "[g]as achieved but local success; it made war uncomfortable, to no purpose. It was not used 1939–45" (Edmonds et al. 1947, vol. 5, 606 n.2). Julian Perry Robinson subsequently argued that the Germans had bungled the strategic potential of poison gas at Ypres, and that the introduction of respirators ensured that gas achieved only a "limited tactical success." The military establishments, he

argued, became "decidedly lukewarm" towards this unpredictable weapon (Robinson 1971, 51–52, 59).

Several scholars have disputed the recollections of Foulkes, claiming that he exaggerated the effects of gas at Loos, overrated the value of cylinder-based gas-cloud attacks, and relied excessively upon the unreliable testimonies of prisoners of war (Haber 1986, 57, 279; Richter 1994, 3, 91–92; Griffith 1994, 116–119). L. F. Haber even claimed that gas was a failure, despite some tactical successes as in precipitating the Italian defeat at Caporetto, October 24, 1917. He contended that gas failed at Second Ypres and Loos, and that it proved unpredictable as respirators blunted its effects: by complicating warfare, gas, unlike the tank, aircraft and the light machine gun, failed to change "the face of war in 1918" (Haber 1986, 264, 270, 278).

3 Gas: Not a War Winner

Poison gas was certainly not a war winner. Its use at the Second Battle of Ypres (April 22–May 25, 1915) followed the unexpected onset of trench deadlock and the failure of conventional weapons to break the stalemate. Professor Fritz Haber, who was then only an unofficial advisor to the German Ministry of War, had pressed the case for experimenting with chlorine gas. General Erich von Falkenhayn never appreciated the potential effects of releasing 149,000 kg of chlorine from 5,730 cylinders (McWilliams and Steel 1985, 41): he saw it as primarily a diversionary move "to cloak the transportation of the [German] troops to Galicia," and admitted that the "surprise effect was very great. Unfortunately we were not in a position to exploit it to the full. The necessary reserves were not ready. The success achieved, however, was considerable" (Falkenhayn 1919, 84–87).

This gas release was far from universally popular. While German infantrymen resented the labor of installing the cylinders in front-line trenches and the days spent waiting for favorable winds, Crown Prince Rupprecht of Bavaria worried that retaliation in kind by the Allies would benefit from the prevailing westerly winds (von Frauenholz 1929, vol. 1, 304–305), and Rudolph Binding wrote in his diary on April 24, 1915, "I am not pleased with the idea of poisoning men. Of course, the entire world will rage about it first and then imitate us" (Binding 1929, 64). This proved true, and Hartley claimed that the Germans had

> made almost every possible mistake in their earliest gas attacks. They chose a gas against which protection could be obtained with comparative ease, they used it in small quantities on narrow fronts in discharges of long duration and low concentration, thus losing the effect in depth, and finally they failed to exploit the partial advantage they gained. Within three weeks we were protected (Hartley 1919–20, 493).

However correct in hindsight, this judgment overlooks "the fact" that the British "were aware" of German preparations for the gas attack for "several days previously" but assumed that "the enemy's attempt would certainly fail", and so "the

terrible effect of the gas came to us as a great surprise" (TNA, WO 32/5483, "Account"). The gas release also caused mass panic among its victims, enabling the Germans to capture over 1,800 prisoners, "more than 51 guns, of which four were heavy, and about 70 machine guns" (Duguid 1938, vol. 2, 320) as well as ground they would hold for another two and a half years. Subsequent attacks were less productive; on April 24 the gas encountered a resolute defense led by Canadians, using improvised protection, to ensure "only a moderate dent in the line" (McWilliams and Steel 1985, 86, 155), and further gas attacks on May 1, 6, 10, and 24 failed to dislodge the Allied grip on the Ypres salient (Spiers 1986, 16–17).

The first designed British response was the Black Veil Respirator, a pad of cotton waste soaked in sodium thiosulphate, sodium carbonate, and glycerol held in place by a long piece of veiling. Issued in May 1915, it afforded only limited protection against chlorine, leaving Yorkshire soldiers to complain about the "rotten gas" that "nearly choked and blinded us" ("Letters" May 28 1915, 6). Much more effective was the Hypo Helmet, a bag with eyepieces and made of flannel, soaked in the impregnating solution, which was put over the head and tucked into the collar. The issue of 2.5 million copies during June 1915, prompted Driver E. Broadley to affirm: "our respirators kept us all right" during a subsequent gas attack ("Letters" June 25 1915, 6). The British later issued the P helmet, impregnated with phenate solution, in anticipation of the enemy using phosgene as they did on December 19, 1915. By adding hexamethylenetetramine, a Russian idea, the PH helmet gave enhanced protection against phosgene, but all helmets were unpleasant to wear. The British eventually devised a large box respirator (LBR) followed by the small box respirator (SBR), in which a flexible rubber tube connected the mask to a filter containing charcoal and sodium permanganate-lime granules. This afforded extra protection against prussic acid, and the SBR became the standard British respirator, issued to all troops by January 1917.[1]

Yet Sir John French, then commander-in-chief of the British Expeditionary Force (BEF), never regarded defensive protection as an adequate response to chemical attacks. As he informed Lord Kitchener, the Secretary of State for War: "We are taking every precaution we can think of but the most effective would be to turn their own weapon against them & stick at nothing" (TNA, Kitchener 1915). Many regimental officers and men agreed. The Germans were "dirty devils," wrote Lieutenant the Hon. William Fraser, "[b]ut we must play their own dirty game as far as the gas goes."[2] Another Gordon Highlander, Lance-Corporal George Ramage, contended: "All war is foul. Why object to gas & not to bullets" (NLS, Ramage 1915). Meanwhile, once Major-General Henry Rawlinson, commander of IV Corps, learned about the depth of the German underground bunkers, he maintained: "What we want is a favourable wind and plenty of good strong chlorine & bromine gas which will sink right down into the deep trenches" (NAM, Rawlinson 1915).

[1]TNA, WO 32/5483, "Diary" and "Account"; WO 142/99, Fergusson 1915.

[2]Fraser, Lt. the Hon. William. 1915. Letter to his Father, May 3. In Fraser 1990, 52.

The British cabinet required several meetings and "considerable discussion" before it approved retaliation in kind (TNA, CAB37/127 and 37/128, 1915). This followed on the first day of the battle of Loos, an offensive demanded by France. Sir Douglas Haig, commander of I Corps, who had reservations about the location and timing of the proposed battle, saw a successful trial discharge of gas at Helfaut on August 22 (IWM, Ashley August 22 1915). Henceforth he declared:

> On the one hand, with gas, decisive results were to be expected. On the other hand, without gas, the fronts of the attacks must be restricted, with the result of concentrated hostile fire on the attacking troops, considerable loss, and small progress! In my opinion the attack ought not to be launched except with the aid of gas! (NLS, Haig 1915)

After successive postponements at the behest of General Joseph Joffre, the BEF launched its first gas assault on the morning of September 25, 1915, when Foulkes, who commanded the newly formed Special Companies of trained chemists, planned to release 150 tons of chlorine from 5,500 cylinders. He recorded in his diary: "Wind was almost calm—SSW—very unfavourable for a gas attack but the battle could not be postponed" (LHCMA, Foulkes 1915). Following the release of chlorine gas and smoke "alternately" (IWM, Ashley September 24 1915), the gas cloud facilitated the advance of the 15th and 47th Divisions on the right of the British attack and assisted the brief capture of the Hohenzollern Redoubt. Elsewhere it moved far too slowly, veering and hanging around the British trenches, with the effects on British forces compounded by leakages, faulty connections, and inadequate training. Even Foulkes, who always insisted that gas caused surprise at Loos,[3] admitted that this attack had been one of "peculiar difficulty" and "extemporization and creation" (LHCMA, Foulkes 1933). Far from breaking through at Loos, the British suffered 59,000 casualties over three weeks, including 2,639 casualties and seven deaths from their own gas in the first three days (Palazzo 2000, 75–77).

4 The Challenge of Chemical Warfare

An inability to cause a breakthrough did not distinguish chemical weapons from any other weapon in 1915. Nevertheless, once used, gas could not be ignored and all the principal belligerents invested in its development. On the Western Front they undertook offensive and defensive research & development, tested new gases and various delivery systems, produced the gases, munitions, and ancillary equipment for an expanding gas war, and formed special gas forces. Under Haber's leadership, the Kaiser Wilhelm Institute for Physical Chemistry and Electrochemistry became committed to the military in February 1916 and expanded steadily into nine departments in various locations around the suburbs of Berlin. By the end of the war it employed 150 academically trained staff, 1,300 non-commissioned officers,

[3]LHCMA, Foulkes 1915 and Foulkes n.d., 5: ch. 20; Foulkes 1936, ch. 5; Foulkes 1962, 179–80.

soldiers, other workers, and additional support personnel. Meanwhile the centralization of French science enabled scientists and laboratories to forge close links between offensive and defensive research in Paris, with another department responsible for application and pilot-plant operation, and a third for purchases and dispatch. Conversely, the French reliance upon state-controlled and smaller independent gas enterprises, often located far from the front, never matched the economies of scale secured by the larger German industrial combines (Stoltzenberg 1993, 133–142; Coleman 2005, 25–26; Hartcup 1988, 105–106).

The British developed entirely separate groups working on offensive and defensive research but, in 1916, the War Office purchased 2,886 acres at Porton Down, where it established an experimental ground. The site expanded steadily over the remainder of the war until it occupied 6,196 acres and enabled Porton to examine 147 toxic substances and conduct field trials of new munitions. Porton also examined individual and collective protection when it acquired the Anti-Gas Department from the Royal Army Medical College in 1917. British industrial support, despite expanding to involve 70 factories by the end of the war, remained less productive than its German counterpart (Carter 1992, 7–25; Haber 1986, 172).

These organizational innovations, coupled with the formation of dedicated chemical corps, testified to the continuing interest in chemical warfare. Although disagreements recurred between scientists and senior military officers, improvisation flourished (Haber 1986, 174–175, 208, 273–274; Hartcup 1988, 106).[4] Faulty cylinder connections, which caused gas leakage at Loos, and were described by R. C. Gale as "a ghastly failure" (IWM, Gale 1915, 70), were corrected with the use of rubber connections. Thereafter the British persisted with cylinders despite their weather dependence, the infantry's dislike of installing them at night in front-line trenches, fear of accidents, and the counter barrage from German gunners whenever the gas was released.[5] As employing cylinders exploited the prevailing westerly winds, and offset the shortage of shells in Britain, the Special Brigade (as Foulkes's expanded force became known) launched 150 of the 220 gas-cloud attacks between April 1915 and November 1918, while the Germans launched 50 and the French 20 (Prentiss 1937, 52; Foulkes 1936, 184–186).

Quite apart from employing gas cylinders, the British introduced the 4-inch Stokes mortar at Loos. On account of its caliber and rate of fire (about twenty rounds a minute), this was an ideal gas weapon, as each round delivered 3 to 4 kg of agent at ranges up to 1,000 m (Prentiss 1937, 362–364). Foulkes praised the Stokes mortar as a versatile weapon that could be brought into action quickly and deliver concentrated amounts of gas over the target area. It could also project smoke barrages during an assault and bombard advanced enemy positions with thermit, bursting the bombs in the air and showering anyone below with globules of molten iron at "white heat" (LHCMA, Foulkes 1917).

[4]On disputes involving Foulkes, see IWM, Hodgkin August 2 1918 and Richter 1994, 183.

[5]TNA, WO 158/270, Barrow 1916; Winter 1979, 126.

Another British invention was the projector, designed by Captain William H. Livens, which was first used at the Somme before the discharge in a mass formation of 2,340 projectors at the opening of the battle of Arras (April 4, 1917). Easily and cheaply produced, the projector fired canisters holding about 15 kg of agent and was not weather dependent. Installed in the ground in batteries just behind the front lines at 45-degree angles, 4,000 projectors could be fired simultaneously by an electrical device. As the Livens projector set up sudden, very high concentrations of agent that neither mortars nor gas shells could emulate, large-scale usage ensued: 4,200 drums (and 3,100 Stokes mortar bombs) were discharged on the eve of the battle of Cambrai (November 1917) and 2,960 drums were fired into St. Quentin on March 19, 1918.[6] Less accurate than mortars or shells, projectors were limited in range (about 1,550 m), but the German 111th Division testified to their impact:

> By this new procedure, the enemy has combined the advantages of gas cloud with those of gas shell, obtaining the density of the former with the surprise effect of the latter. Our losses have hitherto been heavy, because the enemy, in most cases, successfully took us unawares, and gas masks were put on too late (TNA, WO 158/294, July 8 1917).

Nevertheless, gas shells became the primary mode of gas delivery. Although Germany had pioneered the employment of lachrymatory *Ni-Schrapnell* and *T-Stoff* shells in the winter of 1914–15, and then *K-Stoff* shells in the Argonne sector on July 16, 1915, the French proved more innovative in fuse design. By using only a small bursting charge to open their phosgene shells, the French increased both the payload of the shells and the concentration of gas on target (February 1916). As the Germans responded with Green Cross shells, filled with the lethal agent, diphosgene (March 9, 1916), both adversaries exploited the advantages of artillery: accuracy, flexibility, and less dependency on the weather.[7] Gunners ultimately delivered some 85% of the toxic gases during the First World War, and caused about 85% of the gas casualties (Prentiss 1937, 657, 660). Gas shells grew from a negligible proportion of artillery ammunition in 1915 to about 50% of the German, 35% of the French, 25% of the British, and 20% of the American ammunition expenditure by the Armistice. Had the war continued into 1919, all the belligerents planned to employ even more chemical shells.[8]

Gas shells complemented other forms of shelling, as the gases released were multi-purpose area weapons. In preparing for the battle of the Somme, the BEF borrowed 60,000 phosgene shells from France for use in "surprise" salvoes "on front-line trenches, when parapets are manned, and also for counter-battery work" (TNA, WO 158/234). Colonel Georg Bruchmüller refined German artillery tactics on the Eastern Front to neutralize hostile batteries and fire short but highly intensive bombardments at "gas squares." Thereafter his batteries attacked infantry and artillery strong points with as much as 50 or 80% gas shells (TNA, WO I33/1072, Hartley n.d., 8–9). Gas shells were also used to intercept enemies moving at night or

[6]REM, R15, Crowden Report, 1917; *History of the Corps* 1952, 5: 522.

[7]TNA, WO 188/213, Hartley n.d.; Lepick 1998, 182, 184–185.

[8]Prentiss 1937, 657–658, 660, 683–684; TNA, WO 188/213, Hartley n.d.

in advance of night-time raids: as Captain A.E. Hodgkin observed, it was easier to take a German prisoner "when he has got his gas mask on" (IWM, Hodgkin May 23 1918). Latterly, when on the defensive, Germans exploited the persistent effects of mustard gas by saturating areas with Yellow Cross liquid and compelling attacking parties to avoid the contaminated terrain (TNA, WO 158/128, Foulkes 1918).

Similar developments occurred on the Eastern Front. Having experimented unsuccessfully in the cold weather at Bolimov with 18,000 *T-stoff* shells (January 31, 1915), the Germans mounted large-scale poison-gas attacks with cylinders, beginning at Rawka (May 31, 1915). Exploiting the Russian lack of preparedness and protection, they delivered at least ten cylinder attacks over the next eighteen months before introducing more accurate chemical shelling (Main 2015, 116–20, 136). Although estimates of Russian gas casualties are disputed (ibid., 130–131; Prentiss 1937, 653; Krause and Mallory 1992, 16–17), the Russian chemist Professor Vladimir N. Ipatieff, who chaired the Commission for the Preparation of Explosives and later the Chemical Committee of the Chief Artillery Administration, claimed that in the first attack "seven to eight thousand men were poisoned in one night, the majority of whom died" (Eudin et al. 1946, 221). Heavy gas casualties persisted, reflecting recurrent lapses in anti-gas discipline, transport, and distribution problems, and delays in producing effective gas masks through a Tsarist bureaucracy, riven with corruption and incompetence (ibid., 218–226, 230–231).

Over a year elapsed before Russia, hampered by its industrial shortcomings, could retaliate in kind, and, in the second attack, all the casualties were Russian (Main 2015, 126; Krause and Mallory 1992, 26–27). Despite both sides mounting gas operations with cylinders, they used shells predominantly in 1917, where Bruchmüller earned his nickname *"Durchbruchmüller"* ("breakthrough Müller") for artillery assaults, using "gas squares" at the Stochod, East Galicia, and Riga in April, July, and September respectively. In establishing a bridgehead across the Stochod, German gas shells incapacitated the 27th Artillery Brigade and accounted for the capture of two Tsarist divisions. German artillery also employed intense gas barrages in the capture of Seret in East Galicia and in the forcing of the Dvina River in the Riga operation.[9]

What sustained the development of the gas war was the search for more effective chemical warfare agents. The criteria of battlefield effectiveness meant that only several dozen of the thousands of toxic substances examined were employed militarily. This process was still underway in the last few weeks of the war, when the Germans began looking for an agent with more persistence than mustard gas (Robinson 1971, 38–51; Coleman 2005, 26). These substances had to be produced in significant quantities from available materials, thereby confirming the huge advantage that the large German dyestuffs industry had over its rivals. Chemical agents had to be stable in storage, non-corrosive in munitions, relatively safe to handle and transport, and deliverable from a practical military device in sufficient concentration to produce the desired effect on target. Understanding all these

[9]TNA, WO 42/195, Hicks 1917, 204–205; TNA, WO 33/1072, Hartley n. d., 9.

properties took time, fuelling friction between scientists and the military, and between the military and those in charge of wartime supply.

Of the harassing agents used, lachrymators (tear-gases) were employed throughout the war. In 1917, the Germans introduced a new class of solid arsenical sternutators (causing sneezing). Dubbed Blue Cross agents, diphenylchloroarsine (DA) and diphenylcyanoarsine (DC) proved highly irritating but good mask discipline could blunt their effects. The British hoped that adamsite (DM), developed during 1918, would prove a mask-breaking agent in 1919, if used extensively (Robinson 1971, 38–51; Coleman 2005, 26). The Germans led the way in the use of chlorine and phosgene (lethal lung agents), followed by the Allies, with the British employing 50/50% combinations in their White Star gas clouds. The French hoped that the highly toxic blood gases, hydrogen cyanide (prussic acid) and cyanogen chloride, would become effective war gases, but these highly volatile substances had to be mixed with stabilizers, diluents and smoke-markers, and so lethal dosages proved difficult to deliver. The Germans introduced mustard gas (bis (2-chloroethyl) sulfide) at Third Ypres on July 12, 1917 and, by only using it when they had a vast stock available, delivered 2,500 tons of mustard gas in the first ten days from over one million Yellow Cross shells.[10]

5 Effectiveness of the Gas War

The so-called "king of the war gases" transformed the gas war. Highly effective in low concentrations, mustard gas had a slight odor and delayed action, which, coupled with its persistence and capacity to burn and blister through clothing, defied the defensive precautions of the day. Wearing a respirator could thwart its fatal effects, and spreading decontaminants—chloride of lime on guns and bleaching powder on the ground—helped, but mustard gas produced a massive number of casualties. In the first three weeks of Yellow-Cross shelling, the British incurred more casualties (14,276), and almost as many deaths (nearly 500), as they had suffered from all previous gas engagements. From July 12, 1917 to November 23, 1918, British casualty clearing stations admitted 160,970 gas casualties, 1,859 of whom died. 77% of these were victims of mustard gas.[11]

All of the casualties had to be removed for treatment to the rear; the more lightly blistered with swollen eyelids, like Captain Richard Foot, might recover in a week (IWM, Foot n.d., 98); others like T. H. Holmes, gassed on August 22, 1918, found their fighting career over (IWM, Holmes n.d.). As Tim Cook asserts, the best weapons were those that "remove fighting men and leave fear and unrest among the survivors" (Cook 1999, 215): in other words, mustard gas had a psychological effect upon everyone in a gassed area. Its slight odor was difficult to detect amongst

[10]Robinson 1971, 46; TNA, WO 188/213, Hartley n.d.

[11]Macpherson et al. 1923, 2: 294 and 304–308; TNA, WO 142/99, 1917.

the odors of the battlefield and its delayed action caught soldiers unawares, especially those newly deployed at the front. Mustard gas penetrated former places of safety—shell craters and trenches—, demoralizing the tired and exhausted. In rear areas, too, doctors, nurses, and orderlies had to learn how to treat their patients without suffering from cross-contamination.[12]

Having seen 1,400 men gassed in the Villers Bretonneux area, Rawlinson wrote to Winston Churchill, then Minister of Munitions, on April 22, 1918:

> Can you give me any idea when we may expect to have available shells filled with mustard gas? I ask because we have had very severe casualties lately from this form of projectile […] The men naturally feel that the enemy has a distinct advantage over us in possessing mustard gas and the contention of our chemists that our own lethal shells are still more effective, a contention with which I do not agree, is no satisfactory answer. We feel that we are at a disadvantage in this respect and morale suffers as a consequence (NAM, Rawlinson 1918).

Chemical weapons had already become established as a weapon of harassment. In preparations for the battle of the Somme, British army commanders dispersed gas and smoke amidst the preliminary artillery bombardments at "selected places along the whole British front," compelling the enemy "to wear his gas helmets," induce "fatigue," and cause casualties (TNA, WO 256/10, Haig 1916). The ensuing 110 cylinder discharges, mainly dispersing White Star gas clouds at night, harassed the enemy and caused operational degradation. Foulkes later insisted that a cylinder gas cloud was "far more searching in its effects than the cloud produced by projectiles," since it swept over a much more extensive area, penetrating "every nook and cranny," and tested the enemy's defenses more extensively than any other means of discharge (LHCMA, Foulkes, 1917).

Foulkes sought to maximize these benefits by introducing the retired cylinder or beam attack in 1918. Less hazardous to the infantry, who were withdrawn from the front lines when the attacks occurred, the operations involved thousands of cylinders loaded onto flatcars, brought up by rail (or in one case by lorries and horse-drawn wagons) to rear-area positions, and then releasing the gas simultaneously by electrical detonators. Despite losing cylinders in transport accidents, and suffering delays due to lack of wind, the Special Brigade launched ten beam attacks, releasing gas from 27,000 cylinders and achieving greater concentrations of gas than in previous cylinder operations.[13]

Most gas commanders, though, preferred the flexibility of gas shells, projector drums, and mortar bombs. On all sides gunners experimented with the different types of shell and variations in the volume and rate of fire to achieve surprise, inflict casualties, and neutralize enemy batteries or at least reduce the rates of artillery fire. When faced with British gas shells at the battle of Arras, a German commander emphasized the "complete protection" of the German respirators, but acknowledged

[12]Cook 1999, 149–154, 216–17; Heller 1984, 65, 80; Winter 1979, 122–123.

[13]TNA, SUPP 10/292, Foulkes 1918; IWM, Hodgkin July 4–23 1918; LHCMA, Bunker 1965; Foulkes 1936, 291. For a critique of these operations, see Richter 1994, 200–230.

that the "fighting resistance of the men suffered considerably from wearing the mask for many hours." Even worse, horses suffered severely from gas and so the ammunition supply faltered and "the timely withdrawal of batteries could not be affected" (TNA, WO 158/294, von Below 1917).

Various forms of harassment occurred. Once able to fire projectors and 4-inch Stokes mortars in combination, the British bombarded enemy front-line strong points, combining gas with smoke and thermit. Using eleven different fillings in the Stokes mortar bombs and projector drums, the Special Brigade attacked at "all hours of the day and night, and in all wind velocities," even dead calm (TNA, SUPP10/292, Foulkes 1918, 3). They occasionally repeated attacks from the same front after a few hours' interval or disguised attacks by feints with smoke. All this ingenuity reflected the effectiveness of the German respirator once it received a 3-layer drum in June 1916 and further fillings in April 1918. As the Allies were unlikely to penetrate this respirator unless it was damaged or defective,[14] they tried to catch the enemy unawares, distract him, or degrade his fighting efficiency. Even a diversionary bombardment, as took place south-east of Lens in July 1917, involved the delivery of 3,564 drums of gas and 909 mortar bombs across a 3.7 km front over five nights (REM, Crowden, August 3 1917).

During March and April 1918, including Operation Michael (March 21–April 5) the Germans discharged a massive volume of gas. As early as March 9, their "150,000 to 200,000 rounds of Yellow Cross shell […] caused heavy casualties" and, on the morning of March 21, "some millions of rounds of gas shell" targeted forward posts, trenches, strong points, batteries to a depth of 4.8 km, and villages to a depth of 12.9 km. Although the Blue Cross and Green Cross shell combination failed, as the British SBR blocked the penetration of Blue Cross agents, respirators had "to be worn for many hours, thus adding greatly to the strain and fatigue, and hampering movement and communication" (Hartley 1919–20, 499). Intensive gas shell bombardments continued into April 1918, with estimates of 30,000 to 40,000 rounds poured into Armentières on the night of April 7–8, reportedly leaving the gutters running with mustard gas (ibid.; Edmonds et al. 1918, vol. 2, 163).

The SBR minimized fatalities but protection came at a price in fighting efficiency. As Captain Arthur A. Hanbury Sparrow (Royal Berkshires) observed:

> We gaze at one another like goggle-eyed, imbecile frogs. The mask makes you only half a man. You can't think. The air you breathe has been filtered of all save a few chemical substances. A man doesn't live on what passes through the filter—he merely exists. He gets the mentality of a wide-awake vegetable (Hanbury-Sparrow 1932, 309).

German soldiers subsequently bore the brunt of such harassment when the Allies moved onto the offensive in August 1918. The Canadians employed gas shells, up to 20%, in preliminary assaults upon German batteries, command posts, assembly trenches, observation points, and lines of communication (Cook 1999, 189–90). The American Expeditionary Force (AEF) emulated French artillery tactics, both rapid intense gas bombardments at short range to catch the enemy by surprise, and

[14]TNA, SUPP 10/292, Foulkes 1918, 2; *History of the Corps* 1952, 5: 523.

longer, slower barrages to induce fatigue and lower the enemy's physical resistance and morale. They discharged gas in support of infantry attacks, involving 25% of the ordnance delivered. They also employed Stokes mortars in groups, firing phosgene (as well as smoke and thermit) to attack machine-gun nests, weaken resistance, and inhibit counter-attacks (Heller 1984, 86, 88). As soon as the French acquired mustard-gas shells in March, and the British in September, they incorporated them into their fire-plans: over four days from September 26, 1918 onward, the British Fourth Army fired 750,000 shells at the Hindenburg Line, including some 30,000 mustard-gas shells (Lloyd 2014, 181).

Neither at the time nor subsequently has it been possible to evaluate the exact impact of these chemical attacks. Foulkes lacked evidence about the effects of over half the attacks mounted by the Special Brigade, and the remaining evidence from British observation, the testimony of prisoners and deserters, and German letters, diaries and official documents found on the battlefield related largely to the "losses of small units" (TNA, SUPP 10/292, Foulkes 1918, 3). Both Haber and Richter rightly questioned whether much of this evidence withstood scrutiny, both the value of wartime testimony by prisoners of war and deserters, and post-war evidence from incomplete medical records, including the suspicions of malingering among a disproportionate number of the American gas casualties.[15] Yet Richter, unlike Haber, accepts that gas was perceived as a valuable means of harassment (Richter 1994, 224). The steadily increasing use of poison gas by all belligerents on the Western Front, coupled with plans to use it on an even greater scale in 1919, had the war continued, underscored this perception (Palazzo 1999, 39–50; Prentiss 1937, 684).

Finally, any assessment of poison gas during the Great War has to accept that gas was only used because conventional weapons had failed to break the deadlock of the trenches. Thereafter the belligerents relied primarily upon conventional ordnance, namely 2 million tons of high explosives and 50,000 million rounds of small arms ammunition (Prentiss 1937, 656, 662). Nor did the other novel weapons—the tank and airplane—"change the face of war" as Haber alleged (Haber 1986, 270). The Germans employed only nine tanks in their spring offensive and the British used tanks in masses on only two days during the entire war. Neither Cambrai on November 20, 1917 nor Amiens on August 8, 1918 proved decisive because the British lost the vast majority of their machines (of the 414 sent into battle on August 8, only 145 were available one day later and, by August 12, a mere six machines were able to continue). As John Terraine argued: "The German empire was not going to be overthrown by six tanks, any more than by Trenchard's ten bomber squadrons at Nancy" (Terraine 1978, 116). Although the British and French employed aircraft in unprecedented numbers in 1918, dropping 543 tons of bombs on German targets from June 6 until November 11, 1918, these aircraft had only a supportive role. Limited by meteorological conditions during

[15]Haber 1986, 246–248; Richter 1994, 92; US Department of War, Surgeon General's Office, 1926, XIV: 65.

the autumn, these aerial operations were not decisive in 1918 (Edmonds et al. 1947, vol. 5, 577; Terraine 1982, 274–275, 304–306).

In short, chemical weapons were only one of several novel weapons introduced during the Great War. None of these weapons proved war winners in and of themselves, and none of them broke the deadlock of the trenches. All the major belligerents experimented with new gases and means of delivery; they ensured thereby that chemical warfare evolved in scope and method and grew steadily in tonnage, albeit within a largely supportive role. For the British army, the Special Brigade discharged 87,968 cylinders and fired 196,940 projector drums as well as 177,408 Stokes mortar bombs, delivering some 5,700 tons of gas (TNA, SUPP 10/292, Foulkes 1918, 3). By 1919, the British mounted aerial gas attacks against the Bolsheviks, hardly evidence of any failure shrouding the sense of inquiry and experimentation with poison gas (TNA, WO 106/1148, Ironside 1919).

Anti-gas defenses may have been a priority throughout the war, but if the respirators saved lives, they did so at the price of operational degradation and proffered scant protection against the burning and blistering properties of mustard gas. The desperate desire of the Allies to retaliate in kind as soon as they acquired mustard gas in 1918 demonstrated their concerns about the psychological effects and the perceived operational utility of poison gas. As Hanbury-Sparrow observed:

> It wasn't so much the harm it did to the body, which was always much over-estimated in the popular imagination, as the harm it did to the mind […] this harmless-looking almost invisible stuff would lie for days on end lurking in low places waiting for the unwary. It was the Devil's breath (Hanbury-Sparrow 1932, 309–310).

This was hardly a weapon that failed.

References

Auld, Major Samuel. 1922. Chemical warfare. *Royal Engineers Journal* 35: 57–71.

Binding, Rudolph. 1929. *A fatalist at war*. Trans. Ian F.D. Morrow. London: G. Allen & Unwin.

Brown, Frederick J. 1968. *Chemical warfare. A study in restraints*. Princeton, NJ: Princeton University Press.

Carter, Gradon B. 1992. *Porton Down: 75 Years of chemical and biological research*. London: HMSO.

Coleman, Kim. 2005. *A history of chemical warfare*. Basingstoke: Palgrave Macmillan.

Cook. Tim. 1999. *No place to run: The Canadian Corps and gas warfare in the First World War.* Vancouver and Toronto: University of British Columbia.

Duguid, Colonel A. Fortescue. 1938. *Official history of the Canadian Forces in the Great War 1914–1919*. 2 vols. Ottawa: J. O. Patenaude.

Edmonds, Brigadier-General Sir, E. James, et al. 1937. *Military operations: France and Belgium, 1918*, vol. 2. London: HMSO.

Edmonds, Brigadier-General Sir, E. James, et al. 1947. *Military operations: France and Belgium, 1918*, vol. 5. London: HMSO.

Eudin, Xenin, Helen D. Fisher, and Harold H. Fisher (eds.). 1946. *The life of a chemist. Memoirs of Vladimir N. Ipatieff*. California: Stanford University Press.

Falkenhayn, General Erich von. 1919. *General Headquarters 1914–1916 and its critical decisions.* London: Hutchinson.
Foulkes, Major-General Charles H. 1936. '*GAS!' The story of the special brigade.* Edinburgh and London: Blackwood.
Foulkes, Major-General Charles H. 1962. Chemical Warfare now, and in 1915. *Royal Engineers Journal* 76: 177–84.
Fraser, David (ed.). 1990. *In good company: The First World War letters and diaries of the Hon. William Fraser, Gordon Highlanders*. London: Michael Russell.
Fries, Amos A., and Clarence J. West. 1921. *Chemical warfare*. New York: McGraw-Hill Book Co.
Griffith, Paddy. 1994. *Battle tactics of the Western Front: The British Army's Art of Attack, 1916–18*. New Haven: Yale University Press.
Haber, Ludwig F. 1986. *Poisonous Cloud: Chemical warfare in the First World War*. Oxford: Clarendon Press.
Hanbury-Sparrow, Lt.-Col. Arthur A. 1932. *The land-locked lake: Impressions of active service in the European War.* London: Arthur Baker.
Hartcup, Guy. 1988. *The war of scientific invention: Scientific developments, 1914–18*. London: Brassey's Defence Publishers.
Hartley, Brig.-Gen. Harold. 1919–20. A general comparison of British and German methods of gas warfare. *Royal Artillery Journal* 46: 492–509.
Heller, Major Charles E. 1984. *Chemical warfare in World War I: The American experience, 1917–18.* Leavenworth Papers No. 10. Fort Leavenworth.
The history of the corps of royal engineers. 1952. vol. 5. Chatham: The Institution of Royal Engineers.
Imperial War Museum (IWM). 85/22/1. Lt. Charles Allen Ashley. 1915. Diary, August 22 and September 24.
IWM. 86/57/1. Brigadier-General Foot. n.d. Once a Gunner.
IWM. 66/163/1. R. C. Gale. 1915. Diary, September 28.
IWM. 06/30/1. T. H. Holmes, n.d. Memoirs.
IWM, P. 399. Captain Adrian E. Hodgkin. 1918. Diary, May 23, July 4–23, and August 2.
Krause, Joachim, and Charles K. Mallory. 1992. *Chemical weapons in Soviet Military doctrine: Military and historical experience, 1915–1991*. Boulder: Westview Press.
Lefebure, Victor. 1921. *The riddle of the Rhine: Chemical strategy in peace and war*. London: Collins.
Lepick, Olivier. 1998. *La grande guerre chimique: 1914–1918*. Paris: Presses Universitaires de France.
Letters From The Front. 1915a. *Bridlington Free Press*, May 28.
Letters From The Front. 1915b. *Bridlington Free Press*, June 25.
Liddell Hart Centre for Military Archives (LHCMA). King's College London. 2/16. Foulkes Mss. 1915. Diary, 25 September.
LHCMA. 6/13. Foulkes. 1917. Notes on the offensive use of gas and methods of gas discharge. Lecture delivered to commanders and staff officers of the Second Army at Helfaut, April 28.
LHCMA. 6/61. Foulkes. n.d. Draft of his chapter for the *History of the Royal Engineers* 5: Chap. 20.
LHCMA. 6/78. Lt.-Col. S.W. Bunker. 1965. 50th Anniversary Re-union Dinner, 25 September.
LHCMA. G/119. Foulkes. 1933. At a Gas Services Reunion Dinner, February 4.
Macpherson, Walter Grant, et al. 1923. *History of the Great War: Medical services*. Diseases of War. London: HMSO.
McWilliams, James, and R. James Steel. 1985. *Gas! The Battle for Ypres, 1915*. St. Catharine's, ON: Vanwell.
Lloyd, Nick. 2014. *Hundred Days: The campaign that ended World War I*. New York: Basic Books.
Main, Steven J. 2015. Gas on the Eastern front during the First World War (1915–1917). *Journal of Slavic Military Studies* 28: 99–132.

National Army Museum (NAM). Rawlinson Mss. Add Mss. 1952-01-33-18. Rawlinson. 1915. Letter to Maj.-Gen. W.P. Braithwaite, June 25.
NAM. Rawlinson Mss. Add. No. 1952-01-33-21, Rawlinson. 1918. Letter to W.S. Churchill, April 22.
National Library of Scotland (NLS). Acc. 3155. Haig Mss. 1915. Diary, September 16.
NLS. Ms 945. Ramage. 1915. Diary, May 15.
New Technical Weapons. 1915. *The Times*, April 29.
Palazzo, Albert. 1999. Plan 1919—The other one. *Journal of the Society for Army Historical Research* 77: 39–50.
Palazzo, Albert. 2000. *Seeking victory on The Western front: The British Army and Chemical Warfare in World War I*. Lincoln and London: University of Nebraska Press.
Peterson, Horace C. 1939. *Propaganda for war: The campaign against American Neutrality, 1914–1917*. Norman, OK: University of Oklahoma Press.
Prentiss, Augustin M. 1937. *Chemicals in war: A Treatise on chemical warfare*. New York, NY: McGraw-Hill.
Read, James, M. 1941. *Atrocity Propaganda 1914–1919*. New Haven, CT: Yale University Press.
Richter, Donald. 1994. *Chemical soldiers: British gas warfare in World War I*. Barnsley: Leo Cooper.
Robinson, Julian Perry. 1971. The rise of CB weapons. In *The problem of chemical and biological warfare*, ed. Stockholm International Peace Research Institute, vol. 1. Stockholm: Almqvist & Wiksell.
Royal Engineers Museum (REM), R15. Special Brigade re. Gas in World War 1 1915–18.
Crowden. 1917. Report on Operations of the Special Companies, R.E. attached to Canadian Corps, July 15th to August 15th.
REM. R15. Crowden. 1917. Operation Order No. 4/C, August 3.
Spiers, Edward M. 1986. *Chemical Warfare*. London: MacMillan Press.
Stoltzenberg, Dietrich. 1993. *Fritz Haber: Chemist, Nobel Laureate, German, Jew*. Philadelphia: Chemical Heritage Press.
Terraine, John. 1978. *To win a war*. London: Sidgwick & Jackson.
Terraine, John. 1982. *White Heat: The New Warfare 1914–18*. London: Book Club Associates.
The National Archives (TNA). Cabinet Mss. CAB 37/127. 1915. Henry H. Asquith to King George V, 27 April and CAB 37/128. 1915. Asquith to King George V, May 5.
TNA. PRO 30/57. Kitchener Mss. French. 1915. Sir John French to Lord Kitchener, April 27.
TNA. SUPP 10/292. Brigadier-General C. H. Foulkes. 1918. Report on the Activity of the Special Brigade During the War, December 19.
TNA. War Office. WO 32/5483. n.d. An Account of German Cloud Gas Attacks on British Front in France.
TNA. WO 32/5483. n.d. Diary of Development of British Respirator.
TNA. WO 33/1072. Brigadier-General H. Hartley. n.d. Report on German Chemical Warfare Organisation and Policy, 1914–1918.
TNA. WO 42/195. Captain W. L. Hicks. 1917. Gas Services Reports from Russian Front.
TNA. WO 106/1148. Maj.-Gen. Edmund Ironside. 1919. Letter to Gen. Rawlinson, September 16.
TNA. WO I33/1072. Brigadier-General Harold Hartley. n.d. Report on German Chemical Warfare Organization and Policy, 1914–1918.
TNA. WO 142/99. Lt.-Gen. Charles Fergusson. 1915. Gas Attack on VI Corps, December 22.
TNA. WO 142/99. 1917. Report on the Gas Shell Bombardment at Nieuport on Night of 21/22nd July.
TNA. WO 158/128. Brigadier-General C. H. Foulkes. 1918. Summary of Hostile Gas Activity, October 18.
TNA. WO 158/234. Lt.-Gen. Lawrence Kiggell. 1916. Memorandum, June 19 and Maj.-Gen. Archibald A. Montgomery. 1916. Report of the Army Commanders remarks at the conference held at Fourth Army headquarters, 22 June 1916, June 24.
TNA. WO 158/270. Gen. George de S. Barrow. 1916. Report, First Army No. 852(G), August 18.

TNA. WO 158/294. 1917. Effect of British Gas Projectors, containing extract from an order of the 111th Division, July 8.
TNA. WO 158/294. Gen. Fritz von Below. 1917. Experiences Derived From the Arras Battle, April 11 and Hartley. n.d. British and German Methods of Gas Warfare.
TNA. WO 188/213. Brigadier-General H. Hartley. n.d. Chemical Warfare.
TNA. WO 256/10. Haig Diary. 1916. Army Commanders Conference at HQ Third Army, May 27.
Trumpener, Ulrich. 1975. The road to Ypres: The beginnings of gas warfare in World War I. *Journal of Modern History* 47: 460–480.
United States Department of War, Surgeon General's Office, 1926, *Medical department of the U.S. Army in World War. Medical aspects of gas warfare.* XIV. Washington, D.C.: War Department.
von Frauenholz, Eugen (ed.). 1929. *Kronprinz Rupprecht von Bayern, Mein Kriegstagebuch*, vol. 1. Munich: Deutscher National Verlag.
Winter, Denis. 1979. *Death's Men: Soldiers of the Great War*. London: Penguin.

"Gas, Gas, Gaas!" The Poison Gas War in the Literature and Visual Arts of Interwar Europe

Doris Kaufmann

Abstract The gas attacks during the First World War stood for a new kind of warfare and shaped the soldiers' experience of living through an apocalypse never before imagined. This article examines the literary and artistic topics and forms used to express this ordeal by German, British and French writers, poets and painters, the majority of whom had fought in the war. There are striking similarities in their representation of the gas war: the impersonality of this enemy, the feeling of helplessness in gas attacks, the shock of seeing one's comrades "guttering, choking, drowning" and not least the exposure to an infernal landscape. Nearly all of the authors and painters condemned the waste and pointlessness of the ongoing or past war, but their vision of the future often differed according to their national background. The second part of this article addresses the public battle over the interpretation and collective remembrance in the war's aftermath. Particularly at the end of the 1920s, a wave of publications mainly in England and Germany displayed a renewed public interest in the preceding war. The written recollections and paintings of the gas warfare played a significant role here.

In his 1929 war novel *Death of a Hero*, the English writer Richard Aldington depicts at one point how his protagonist—a soldier stationed on the Western Front but a modern painter in civilian life—attempts in vain to sketch a military engagement he once experienced, a combat operation that included heavy artillery shelling, a long-lasting barrage of gunfire, and a gas grenade attack. Although he sees "the ruined village" and "the broken desecrated ground" in front of him and hears "the 'claaang' of the heavies dropping reverberantly into M—," "his hand and brain" fail him (Aldington 2013, 315–316). He destroys both of his pre-war drawings, along with an old self-portrait. Aldington describes here one of the answers to the problem that was inevitably posed for the European avant-garde artists immediately after the outbreak of the war. In 1914 many of them had volunteered enthusiastically to go to war, a war from which they hoped to

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B. Friedrich et al. (eds.), *One Hundred Years of Chemical Warfare: Research, Deployment, Consequences*, DOI 10.1007/978-3-319-51664-6_10

experience a purification and also a destruction of societies they regarded as outdated, decrepit, and suffocating, and from which they expected the birth of a "New World of Art" and, even more, of a "New Age." Soon after the turn of the century, the avant-gardists had already commenced with their artistic "fragmentation of reality" (in the words of Gottfried Benn) and were creating a new kind of art both in form and content. But how should the unprecedented and initially incomprehensible experiences in the industrialized war of materials be dealt with and expressed artistically: the mass killings and mass deaths, the new demands imposed on perception and behavior induced by the long-range artillery rounds, machine gun deployments, and drumfire, by gas, grenades, aerial bombs, and the first tank attacks? (For a survey, see Jürgens-Kirchhoff (1993), Cork (1994), Kunst- und Ausstellungshalle der Bundesrepublik Deutschland in Bonn (2013).)

Part I

As early as September 1914, the war volunteer Franz Marc wrote with a sense of amazement:

> It is incredible that there were times in which one represented war by painting campfires, burning villages, falling horses or riders on patrol and the like. This idea strikes me as downright comical, even if I think about Delacroix […], we must do this completely differently, completely differently! (Marc 1989, 102–103)

The French writer Léon Bloy also asked himself, after visiting an exhibition of war paintings, how one could express the reality of this war "without making oneself ridiculous and without becoming a liar" (Robichon 1994, 296). A clear answer was provided in 1917 by the art historian Richard Hamann. Modern battle, Hamann wrote, had become impossible to portray. A representational portrait of a large battlefield would be unable to depict human beings at all. It could only display a vast field, ruins, vapors, clouds, and sky. Above all—according to Hamann —"the mass, the quantum of suffering that such a war has brought on the world cannot even be intimated by condensing it onto the narrow space of a picture" (in Jürgens-Kirchhoff 1993, 18).

But this was precisely what visual artists from a number of countries, almost without exception combatants and veterans, were attempting as they created important works—works they were already making during the war as well as in the 1920s and 1930s. These paintings are important or relevant because they had a major impact on contemporaries, an impact the viewer of today still senses. They often facilitate a deeper insight into the World War beyond factual knowledge. Therefore this group of sources is of particular relevance for my inquiry, namely the paintings of visual artists who dealt with the war in a critical way. Their reception by contemporaries shows that these works expressed dimensions and interpretations of the war that reverberated in postwar societies and have also found their way into our contemporary cultural memory. Pictures that were apologetic about the war are not examined here. This is due to the thematic aspect that is the focus of attention

here. As a pictorial subject, the gas war does not lend itself—saying this is almost a banal statement—to affirming war, and it is poorly suited as a motif for trivializing war, though in anti-German war cartoons after 1915 it certainly lent itself to an "irrefutable illustration of 'Hun' barbarity"[1]

Anyone examining the immense inventory of pictures from the First World War will notice that the European avant-garde artists, as well as the painters of other art movements critical of academicism, did not make the gas war one of their favored subjects. The "lack of pictorialness" in modern war lamented by contemporaries,[2] especially because the individual soldier's achievement had become invisible—for which the London *Times* found the apposite phrase "the butchery of the unknown by the unseen"[3]—became particularly apparent in depictions of the gas war. What might initially seem to be the obvious and conventional approach—painting the ostensibly visible, that is, the emptiness of the ravaged battlefield, with swathes of gas—left the viewer in the dark, since the swathes might signify anything from poison gas to artificial fog or the smoke of artillery and grenade fire. This is obvious when looking at the two paintings by Ferdinand-Joseph Gueldry and Georges Leroux (Figs. 1 and 2).

Fig. 1 Ferdinand-Joseph Gueldry, Le ravin de la mort à Verdun, 1916

[1]This refers to the Dutch cartoonist Louis Raemekers's work (Das 2012, 398–399).

[2]According to the sculptor Erich Stephani, in Leonhardt (2014, 598).

[3]*The Times*, November 1914, in Bogacz (1986, 661).

Fig. 2 Georges Leroux, L'enfer, 1921, Imperial War Museum London

Fig. 3 Gas attack photographed from the air, Imperial War Museum London

Leroux's painting recalls one of the battles at Verdun in 1916 where phosgene was used for the first time. The view of the scene by these two artists here is competing with photography, the frequently used new medium that could presumably capture the moment more accurately and with a claim to "authenticity" (see Hüppauf 1992, 2004a) (Fig. 3).

Most importantly, the terror of gas attacks is rather absent in the two paintings. Yet works of art were created in which painters took up the challenge that a British art critic had posed to them, namely "to recover the 'truth' of modern war" (Bennett). Since this "truth" was hidden behind the visible reality, it seems logical that elements of cubism and futurism (rather than the more naturalistic conventions of pre-war painting) dominate the two works of art by Otto Dix and Robert Williams introduced below (Fig. 4).

Fig. 4 Otto Dix, Lichtsignale, 1917

In 1917 the war volunteer and machine-gunner Otto Dix painted a gouache entitled *Lichtsignale* ("Light Signals"), (Fig. 4). Green, red, and white flares warned of gas attacks, acting as a kind of "Gas S.O.S" (Spear and Summersgill 1991, 310). They signaled the beginning of the terror whose end Dix had painted here. In the literature written by war veterans, too, flares are a constantly repeated theme. Thus, Edlef Koeppen writes in his novel *Heeresbericht* ("Army Communiqué") from 1930:

> 'Lieutenant, Sir!' He cannot say more than that. Red flares dance in front before his eyes. The green against the morning sky can only be seen dimly, which makes the red more menacing. Green-red everywhere. From Loos to the dump, like a veil, green-red is dancing, whirling. At the same time, mind-boggling gunfire. 'Gas!' All three of them shout this at the same time" (Koeppen 1992, 191).

The Vorticist William Roberts, an artist from the English prewar avant-garde, served until the end of 1917 as a machine gunner before he painted "The First German Gas Attack at Ypres" in the spring of 1918 as official military artist for the Canadian War Memorials Fund (see Gough 2010, 278–290; Malvern 2004, 122–124) (Fig. 5). The picture was shown in 1919 at the London Royal Academy of Arts in the exhibit "The Nation's War Paintings," where it generated controversy. In a panic-like flight from the gas clouds, Franco-Algerian soldiers in blue-red

Fig. 5 William Roberts, The First German gas attack at Ypres, 1918, National Gallery of Canada, Ottawa

uniforms come up against a rearward position occupied by Allied Canadian troops. A chaotic tangle of suffering men, not exactly a heroic narrative for a victorious nation—the Canadians ultimately did hold their emplacement—is what Roberts had painted.

Like William Roberts, other English artists also wanted to convey the horrendous front-line experiences they had gained in a war in which technology had long since carried any kind of heroic romanticism to the point of absurdity. In the last year of the war, the painter Paul Nash wrote:

> I am no longer an artist interested and curious. I am a messenger who will bring back word from the men who are fighting to those who want the war to go on for ever. Feeble, inarticulate, will be my message, but it will have a bitter truth, and may it burn their lousy souls" (in Jürgens-Kirchhoff 1993, 382, fn 110).

How artists could express this "bitter truth" of the gas war is something the English public was able to view as early as the spring of 1918 in several nationwide exhibitions (Malvern 2004, 37–55; Hynes 1990, 198–202) (Figs. 6 and 7).

None of the relentless pictures of artists like William Rogers, Eric Kennington, Gilbert Rogers or Paul Nash became a "corner stone" in "the public's imagination

Fig. 6 Eric Kennington, Gassed and Wounded, 1918

Fig. 7 Gilbert Rogers, Gassed: In Arduis Fidelis, 1919

in the decades after the Great War."[4] This key position in the public imagination was occupied by another work, the monumental painting "Gassed" by John Singer Sargent (Fig. 8).

The British War Memorials Committee had commissioned Sargent, a very well-known American portraitist and salon painter of the late nineteenth century, to contribute a mural for the Hall of Remembrance the Committee had been planning. Sargent visited the Western Front from July through September 1918, where he witnessed the impact of a German mustard gas attack near Arras. The huge oil painting, measuring six by three meters, was selected by the Royal Academy as the picture of the year for 1919 and was admired by Winston Churchill "for its brilliant genius and painful significance."[5] Yet there were also critical voices. After visiting the exhibition in the Royal Academy, Virginia Woolf saw Sargent's painting as testimony to the belief in soldierly suffering as something that has to be counted as the price that must be paid for the "greater good of the Empire" (Harvey 2010, 149).[6] The pathway of the apparently more lightly wounded blond men with clean head bandages walking upright —two of them still carrying a gun—to the dressing station (indicated on the far right of the picture by tent poles) is depicted as a sunlit sacrificial path.

[4]Gough (2010, 197–200), on Sargent, p. 197.

[5]*The Times*, 5 May 1919, in Harvey (2010, 148).

[6]On the shifting reception of Sargent's painting—exhibited in the Imperial War Museum—between 1920 and 1939, see also Malvern (2000).

Fig. 8 John Singer Sargent, Gassed, 1919

Five years after Sargent's picture, Otto Dix published two etchings of gas victims that are far removed from causing such an impression (Figs. 9 and 10).

Fig. 9 Otto Dix, Die Schlafenden von Fort Vaux (Gas-Tote), in: Mappe "Der Krieg," 1924

Fig. 10 Otto Dix, Gas Tote (Templeux-La-Fosse, August 1916), in: Mappe "Der Krieg," 1924

There is no need for any statement from Dix about how he wanted to show the war "without all the propaganda."[7] The two etchings come from his 50-sheet portfolio *The War*. It was issued with an afterword by Henri Barbusse, the author of the first autobiographically inspired anti-war novel *Le Feu* in 1916. Its publication was accompanied by an exhibition tour in Germany taking place in 1924—the very year the pacifist movement had declared as the Antiwar Year (Schubert 2002, 39–46). Dix's pictures of the First World War need to be placed in the political context of the antiwar movement that gained influence in the mid-1920s (Riesenberger 1990, 250–275; Holl 1988, 138–204). In Germany it competed with a national-conservative, militaristic camp and its interpretation of the World War as an opportunity for the rebirth of an antidemocratic nation, ready for war and structured along authoritarian lines (to summarize this political vision in very abbreviated fashion). Ten years after the World War's end, the debate about how to interpret its meaning picked up noticeably, especially in Germany and England (Hynes 1990, 423–459; Hüppauf 2004b; Eksteins 1989, 275–299). At the center of this debate were also literary works, often with an autobiographical background, in which the authors tried to come to terms with their frontline experience during the war.

Part II

The second part of this article examines the different ways in which the gas war was recalled in the anti-war and pro-war literature, the contexts in which the gas war appeared, and which general interpretation of the war was promoted by the gas war narratives.

As in the visual artworks, suffering and death by gas constitute an important topic in the war literature. In his poem "Dulce et Decorum Est," Wilfred Owen, the famous English war poet who died in battle shortly before the end of the war, put the agonizing physicality of death by gas into haunting words:

> Gas! GAS! Quick boys!—An ecstasy of fumbling,
> Fitting the clumsy helmets just in time;
> But someone still was yelling out and stumbling,
> And flound'ring like a man in fire or in lime…
> Dim, through the misty panes and thick green light,
> As under a green sea, I saw him drowning.
> In all my dreams, before my helpless sight,
> He plunges at me, guttering, choking, drowning.
> If in some smothering dreams you too could pace

[7]Thus Otto Dix in an interview from 1957, in Dix (2014).

Behind the wagon that we flung him in,
And watch the white eyes writhing in his face,
His hanging face, like a devil's sick of sin;
If you could hear, at every jolt, the blood
Come gargling from the froth-corrupted lungs, […][8]

In her moving autobiography, Mary Britnieva, who was employed as a voluntary nurse on the Eastern front, likewise describes the shock of having to stand by helplessly and watch the agony of gas poisoning:

> They lay on their backs mostly, their upturned faces terribly swollen and livid—some almost blue—choking and coughing, their bloodshot eyes protruding, unable to utter a word, yet fully conscious, only their eyes and their occasional spasmodic feeble movements proclaiming the supreme agony that they were enduring. Some were even coughing up pieces of their lungs that the cruel gas had disintegrated in their living bodies. […] The realization of our helplessness was almost unbearable; a wound can be dressed and the flow of blood from a hemorrhage can be staunched, but this fiendish weapon had got science and surgery beaten."[9]

In the last volume of his serial novel *Les Thibault*, Roger Martin du Gard, the French writer who was awarded the Nobel Prize in Literature in 1937, confronts his readers with a lengthy depiction, replete with all the medical details, of how it takes months for his protagonist, a physician who himself becomes the victim of a mustard gas attack during the inspection of a hospital for gas poisoning cases, to die (Martin du Gard 1972). If Owen, Britnieva, and Martin du Gard are plainly articulating their subjective concern and compassion in the face of the gas poisoning victims, these kinds of emotions are more noticeable by their absence from other writers' accounts. In *Storm of Steel*, Ernst Jünger is rather detached as he describes the following scene:

> [I]n Monchy we saw a lot of men affected by gas, pressing their hands against their sides and groaning and retching while their eyes watered. It was a sad business, because a few of them went on to die over the next several days, in terrible agony. […] Henceforth, I resolved never to go anywhere without my gas mask. (Jünger 2004, 81; 1993, 92)

The steel-hard Stormtroop stoicism praised a bit later by him—"If a man falls, he's left to lie. No one can help. No one knows if he'll return alive" (Jünger 2004, 92; 1993, 104)—is illustrated by another author who also belonged to the camp of soldierly nationalism. Werner Beumelburg writes in his best-selling novel of 1930, *Die Gruppe Bosemüller* ("The Bosemüller Group"):

> The fire trench is crashed to a pulp. They stumble across a couple of figures who are sitting there. Why aren't they going any further? […] 'Comrade,' one of them whispers, holding fast to the lieutenant's leg. 'What's wrong? What are you doing here?' 'Gas…' In the spraying flares of a hundred flames one sees their ghostly-yellow faces, their elongated necks, their circularly lacerated eyes. They regurgitate. They gasp for breath. Somebody, out of sheer

[8]Wilfred Owen, "Dulce et Decorum Est," in Barlow (2014, 40). Owen's poem is the focus of Das (2012).

[9]Mary Britnieva, *One Woman's Story*, in Hallett (2010, 75).

> helplessness, has wrapped bundles of bandages around their throats […] 'Comrade' is whispered, as the lieutenant's leg is clutched […] He tears his leg away with force. 'Comrade…' 'Forward!' screams the lieutenant. 'Form groups of four men […,] wait over there in the fire trench in front of the Vaux-Cross […]—Move on in' (Beumelburg 1930, 271–272).[10]

In her book *Augenblicke der Gefahr: Der Krieg und die Sinne* ("Moments of Danger: The War and the Senses"), the literary scholar Julia Encke has tellingly explored the measures undertaken to armor the individual against the imperceptible gas weapon (Encke 2006, 197–218). Indeed, a recurrent topic in the war literature are the emphatic descriptions of soldiers' attempts to locate gas before, during, and after the attack by way of hearing, smell, and vision. Whistling hisses, the peculiar way that gas grenades pop up, the specific formation and color of the gas clouds, the smell of bitter almonds, sweet onions, of apples, mustard, and garlic, and in particular the way comrades are watched—are there any consequences as soon as they take off their gas masks?—are frequent themes.[11] In order to make this barely discernible danger of gas describable, a menacing bodily shape is often ascribed to the gas. In Erich-Maria Remarque's *Im Westen nichts Neues* ("All Quiet on the Western Front"), the puffs of gas become a soft jellyfish animal that lays itself down in the craters and stays there to loll (Remarque 1980, 54). As depicted by Werner Beumelburg, gas is a creature that has dead eyes and frozen hands, that longingly extends its frozen hands, is not forgetful of a single crack in the ground, trickles and flows and spreads (Beumelburg 1930, 286–287).

The anonymity of the modern battlefield becomes all-encompassing. Not only is the enemy invisible; people on the own side become indistinguishable behind the gas mask. During a gas attack, the Russian officer Fedor Stepun remembers "the terrible unrecognizability of all the people all around, the loneliness of an accursed, tragic masquerade: white rubber skulls, quadratic glass eyes, long green snouts" (Stepun 1963, 318–19) (Fig. 11). There is a similar description by Richard Aldington in his war novel *Death of a Hero*. His protagonist, Winterbourne, undergoes a gas attack's aftermath. He

> stood at the end of the trench to help out the groping, half-blinded men. As they filed by, grotesques with india-rubber faces, great, dead-looking goggles, and a long tube from their mouths to the box respirators, Winterbourne thought they looked like lost souls expiating some horrible sin in a new Inferno. (Aldington 2013, 279)

How much the experience of such an unprecedented kind of inferno was shared by combatants from all countries is also demonstrated by the following passage from *Storm of Steel* by the German writer Ernst Jünger:

> With weeping eyes, I stumbled back to the Vaux woods, plunging from one crater into the next, as I was unable to see anything through the misted visor of my gas mask. With the

[10]On Beumelburg, see also Krumeich (2011).

[11]For an example, see Dorgelès (1988, 261): "Bouffioux lay huddled in a corner and no longer even wanted to remove his gas mask; the smallest little cloud of powder pressing down on us frightened him. For a whole hour we heard him stammering: 'That smells like apples … That smells like mustard … That smells like garlic …' and each time he anxiously slipped on his pig snout. Now he was no longer even taking it off, and the way he hunkered down in his hole with his wagging head made him resemble a carnival monster."

Fig. 11 Henri de Groux, Masques à gaz, 1916

> extent and inhospitableness of its spaces, it was a night of eerie solitude. Each time I blundered into sentries or troops who had lost their way, I had the icy sensation of conversing not with people, but with demons. We were all roving around in an enormous dump somewhere off the edge of the charted world. (Jünger 2004, 114; 1993, 129) (Fig. 12)

Modern weapons technology has transformed the landscape into a gigantic scrapyard. So it is not surprising that the central figure in Edlef Koeppen's *Heeresbericht*, Lieutenant Reisinger, heads off not unwillingly, together with a noncommissioned officer, on a reconnaissance mission beyond the immediate combat zone. They marvel at the sunlit green grass, the many poppy flowers, and the young birch forest nearby. Then all of a sudden the warning cry: "The leaves aren't green, but lilac" (Koeppen 1991, 356). The woods have been gassed, and even the white stems are sprayed with a greasy lilac-red fluid. Nature itself has become a weapon. The crossing turns into a problem. "For heaven's sake, don't bump into just any tree. Don't touch any leaf. Hands in your pockets. Make yourself as tight and small as possible" (ibid., 358). It is not about to turn out well. The noncommissioned officer fails to notice—with the open field already in front of him—an overhanging birch branch, which tears off his gas mask. He dies right in front of Reisinger, who is as helpless as he is shocked. Not coincidentally, Koeppen has placed this scene almost at the end of his book. It is jointly responsible in a

Fig. 12 Otto Dix, Die Sturmtruppe geht unter Gas vor, Kriegsmappe 1924

fundamental way for Reisinger's ultimate "breaking point"—as the English war veteran Robert Graves called it in his book *Goodbye to All That* (Graves 2000, 164). Koeppen's Reisinger brings his personal war to an end and ends up in a psychiatric hospital. Aldington's hero too shares a similar experience after a day-long battle with a massive use of gas. Toward the end of the war he senses "a cut in his life and personality," and "a sense of fear he had never experienced," which allows him to continue fighting only with a huge expenditure of coercion (Aldington 2013, 293–294). Finally, he commits a hidden suicide. An open admission like that of Fedor Stepun—"but hovering over all this, the insane fear of a difficult and disgusting death (by gas)" (Stepun 1963, 319)—is seldom found in the war literature. In any event, such a confession would only be expected in the pacifist war literature, though even here the nearly ineluctable dictate that doubtless prevailed among contemporaries was bravery against the enemy under all circumstances. However, the aforementioned Robert Graves, author of the best-known 1929 English war book with its telling title, links in this memoir his condition of suffering from bad nerves with his experience of poison gas attacks on the Western Front. "Since 1916, the fear of gas obsessed me: any unusual smell, even a sudden strong scent of flowers in a garden, was enough to send me trembling" (Graves 2000, 220; see also 217–218).

The autobiographically guided front literature largely screens out what caused and who was responsible for the gas war. These questions are, however, at the center of some plays, novels, and science fiction literature that appear around the same time. These works of art focus on the war-inducing nexus linking the chemical gas-producing armaments industry, the military, and government policy to each other and contemplate different ways to break up this military-industrial complex (Fig. 13).

Fig. 13 Gerd Arntz, Fürs Vaterland, 1936

In this context, the expressionist playwright Georg Kaiser uses two of his plays that were Europe-wide hits, *Gas* and *Gas 2* from 1918 and 1920, to warn against the way technological knowledge and technological processes create rules and an order of their own (Kaiser 1978). At the end of *Gas 2*, a poison gas explosion destroys all of civilization. In 1926 Johannes R. Becher, who later becomes the first Minister of Culture in the German Democratic Republic, published his gas warfare novel *CHCl = CH)$_3$ As (Levisite) oder Der einzig gerechte Krieg* ("Levisite or The Only Just War"), which was immediately banned by the censor. Becher creates an apocalyptic global class war that is conducted by capitalist governments with aerial poison gas bombings against the population and workers' armies. In his novel he alludes to existing literary narratives about the recent gas war. Building scientific treatises about chemical agents and the injuries caused by poison gas into his horror story, Becher goes on to contrast this doomsday scenario with a bright Communist future that he illuminates for the reader. In one part of that future world, the proletariat, protected by the Soviet air fleet, will own and control the industries that make chemical dyes and weapons (Becher 1985).[12]

With his assumption that the war of the future would be an aerial war using gas and bacteria, in which cities would be gassed and the population thereby drawn into what is now a total war, Becher falls into line with the new horror scenario invoked by literature in the 1920s and 1930s. In France, Germany, England, Italy, and the USA, pacifist writers, but also authors from military circles and authors of science fiction in postwar Europe, conducted a *Zukunftskrieg* (future-war fiction) in which the inhabitants of Paris, London, and Berlin as well as entire tracts of land were sometimes destroyed from the air by poison gas. If these scenarios as employed by pacifist writers were meant to warn against a new war, in the hands of the military

[12]For a detailed discussion, see Berman (1985); Vollmer (2003).

authors they served to promote a new arms buildup or rearmament for each country's air force (Schütz 2005).

In the war literature of all the countries that participated in the First World War, there are hardly any differences in how the new perceptional and behavioral impositions caused by the gas war are represented. Gas warfare intensified the impression of the enemy's anonymity as well as magnifying the unrecognizability —in Stepun's words—"of all people all around" (Stepun 1963, 318). Furthermore, in many of the European literary and pictorial works on the war the destruction of nature and of the landscape by modern weapon systems is addressed and condemned. The artists are aware that this devastation had been heightened even more by the gassing of the environment, which becomes a weapon in its own right. Helplessness in the face of agonizing dying and of death by gas is also a common theme in literature and visual arts of interwar Europe, frequently coupled with horror visions of a future total gas and aerial warfare.

Yet there are differences: That soldiers often reacted to the "new Inferno" of the gas war with a mental breakdown—suffering a gas shock as a variation of shell shock—is addressed almost only by English writers, whose military career prohibited the verdict of cowardice often associated with breakdown.[13] Robert Graves and Richard Aldington, gas victims themselves, used their descriptions of psychological injuries at the end of the 1920s to affirm their overall interpretation of the war as completely meaningless. This places them in the ranks of those European writers and visual artists who had already come to the same conclusion during the war and in the 1920s like Wilfred Owen, Henri Barbusse, Roland Dorgelès, Erich Maria Remarque, Edlef Koeppen, Roger Martin du Gard, and Fedor Stepun, to mention only the authors quoted above.[14] In the German spectrum of writers, however, a completely different interpretation was propagated by the advocates of soldierly nationalism who glorified the war experience like Ernst Jünger and Werner Beumelburg. The former Stormtroop officers saw an armored and heroic "New Man" emerging from behind the gas clouds of the war. Their combat continued after 1918—this time against the Weimar Republic.

References

Aldington, Richard. 2013 [1929]. *Death of a hero*. London: Penguin.

Barlow, Adrian, ed. 2014. *Six poets of the Great War*. Cambridge: Cambridge University Press.

Becher, Johannes R. 1985 [1926]. *(CHCl = CH)$_3$ As (Levisite) oder Der einzig gerechte Krieg*. Berlin, Weimar: Aufbau.

Bennett, Lloyd. Richard Jack: Canada's Battle Painter. http://visualarts.inside.tru.ca/files/2014/06/Richard-Jack-Canadas-Battle-Painter1.pdf. Accessed 6 Oct 2016.

[13]This point has been emphasized in Cook (1999, 233–238).

[14]In this context, the historian Jay Winter emphasizes a "communality of European cultural life in the aftermath of the war" (Winter 1995, 227).

Berman, Russell A. 1985. The politics of form and the discourse of war in Johannes R. Becher's Levisite. *Modern Language Studies* 15 (4): 110–116.
Beumelburg, Werner. 1930. *Die Gruppe Bosemüller*. Gerhard Stalling: Oldenburg.
Bogacz, Ted. 1986. 'A Tyranny of Words': Language, poetry, and antimodernism in England in the First World War. *Journal of Modern History* 58 (3): 643–668.
Cook, Tim. 1999. *No place to run: The Canadian corps and gas warfare in the First World War*. Vancouver: University of British Columbia Press.
Cork, Richard. 1994. Das Elend des Krieges: Die Kunst der Avantgarde und der Erste Weltkrieg. In *Die letzten Tage der Menschheit: Bilder des Ersten Weltkrieges*, ed. Rainer Rother, 301–396. Berlin: Ars Nicolai.
Das, Santanu. 2012. 'An Ecstasy of Fumbling': Gas warfare, 1914–18 and the uses of affect. In *The Edinburgh companion to twentieth-century British and American war literature*, ed. Adam Piette and Mark Rawlinson, 396–405. Edinburgh: Edinburgh University Press.
Dix, Otto. 2014. 'Schade um die Kerle': Was Otto Dix in den Schützengräben des Ersten Weltkriegs erlebte—und wie er dieses Trauma als Künstler verarbeitete. Hier kommt er selbst zu Wort. *Die Zeit*, April 16. http://www.zeit.de/2014/17/otto-dix-feldpost/.
Dorgelès, Roland. 1988 [1919]. *Die hölzernen Kreuze* [*Les croix de bois*]. Leipzig, Weimar: Gustav Kiepenheuer.
Eksteins, Modris. 1989. *Rites of spring: The Great War and the birth of the modern age*. Boston, MA: Houghton Mifflin.
Encke, Julia. 2006. *Augenblicke der Gefahr: Der Krieg und die Sinne*. Munich: Wilhelm Fink.
Gough, Paul. 2010. *A terrible beauty: British artists in the First World War*. Bristol: Sansom and Company.
Graves, Robert. 2000 [1929]. *Goodbye to all that*. London: Penguin.
Hallett, Christine E. 2010. Portrayals of suffering: Perceptions of trauma in the writing of First World War nurses and volunteers. *Canadian Bulletin of Medical History* 27 (1): 65–84.
Harvey, Benjamin. 2010. Virginia Woolf, art galleries and museums. In *The Edinburgh companion to Virginia Woolf and the arts*, ed. Maggie Humm, 140–159. Edinburgh: Edinburgh University Press.
Holl, Karl. 1988. *Pazifismus in Deutschland*. Frankfurt am Main: Suhrkamp.
Hüppauf, Bernd. 1992. Kriegsfotografie an der Schwelle zum Neuen Sehen. In *Geschichte und Psychologie*, ed. Bedrich Loewenstein, 205–233. Pfaffenweiler: Centaurus.
Hüppauf, Bernd. 2004a. Ikonographie. In *Enzyklopädie Erster Weltkrieg*, ed. Gerhard Hirschfeld, Gerd Krumeich, and Irina Renz, 569–570. Paderborn: Ferdinand Schöningh.
Hüppauf, Bernd. 2004b. Kriegsliteratur. In *Enzyklopädie Erster Weltkrieg*, ed. Gerhard Hirschfeld, Gerd Krumeich, and Irina Renz, 177–191. Paderborn: Ferdinand Schöningh.
Hynes, Samuel. 1990. *A war imagined: The First World War and English culture*. London: Pimlico.
Jünger, Ernst. 1993 [1920]. *In Stahlgewittern*. Stuttgart: Klett-Cotta.
Jünger, Ernst. 2004 [1920]. *Storm of steel*. Trans. Michael Hofmann. New York, London: Penguin.
Jürgens-Kirchhoff, Annegret. 1993. *Schreckensbilder: Krieg und Kunst im 20. Jahrhundert*. Dietrich Reimer: Berlin.
Kaiser, Georg. 1978. *Gas: Schauspiel*. Frankfurt am Main: Ullstein.
Koeppen, Edlef. 1992 [1930]. *Heeresbericht*. Reinbek: Rowohlt.
Krumeich, Gerd. Zwischen soldatischem Nationalismus und NS-Ideologie: Werner Beumelburg und die Erzählung des Ersten Weltkriegs. In *Burgfrieden und Union sacrée: Literarische Deutungen und politische Ordnungsvorstellungen in Deutschland und Frankreich 1914–1933*, eds. Wolfram Pyta and Carsten Kretschmann, 295–312. Munich: Oldenbourg.
Kunst- und Ausstellungshalle der Bundesrepublik Deutschland in Bonn, ed. 2013. *1914: Die Avantgarden im Kampf*. Cologne: Snoeck.
Leonhardt, Jörn. 2014. *Die Büchse der Pandora: Geschichte des Ersten Weltkriegs.* Munich: C.H. Beck.
Malvern, Sue. 2000. War, memory and museums: Art and artifact in the Imperial War Museum. *History Workshop Journal* 49: 177–203.

Malvern, Sue. 2004. *Modern art, Britain and the Great War: Witnessing, testimony and remembrance*. New Haven, CT, London: Yale University Press.
Marc, Franz. 1989. *Briefe, Schriften und Aufzeichnungen*, ed. Günter Meißner. Leipzig, Weimar: Kiepenheuer.
Martin du Gard, Roger. 1972. *Les Thibault*, vol. 5: *L'été 1914. Épilogue*. Paris: Gallimard.
Remarque, Erich-Maria. 1980 [1928]. *Im Westen nichts Neues*. Frankfurt am Main: Ullstein.
Riesenberger, Dieter. 1990. Der Kampf gegen den Gaskrieg. In *Lehren aus der Geschichte? Historische Friedensforschung*, ed. Rainer Steinweg, 250–275. Frankfurt am Main: Suhrkamp.
Robichon, François. 1994. Ästhetik der Sublimierung: Die Französische Kriegsmalerei. In *Die letzten Tage der Menschheit: Bilder des Ersten Weltkrieges*, ed. Rainer Rother. Berlin: Ars Nicolai.
Schubert, Dietrich. 2002. Otto Dix: Die Radierungen 'Der Krieg' von 1924. *Kunsthistorische Arbeitsblätter* 9: 39–46.
Schütz, Erhard. 2005. Wahn-Europa: Mediale Gas-Luftkrieg-Szenarien der Zwischenkriegszeit. In *Krieg in den Medien*, ed. Heinz-Peter Preußer, 127–147. Amsterdam: Rodopi.
Spear, Hilda D., and Sonya A. Summersgill. 1991. Poison gas and the poetry of war. *Essays in Criticism* 4: 308–323.
Stepun, Fedor. 1963 [1929]. *Als ich russischer Offizier war.* Munich: Kösel.
Vollmer, Jörg. 2003. Gift/Gas oder das Phantasma der reinigenden Gewalt. Johannes R. Becher: $(CHCl = CH)_3$ As (Levisite) oder der einzig gerechte Krieg (1926). In *Von Richthofen bis Remarque: Deutschsprachige Prosa zum I. Weltkrieg*, eds. Thomas F. Schneider and Hans Wagener, 181–193. Amsterdam: Rodopi.
Winter, Jay. 1995. *Sites of memory, sites of mourning: The Great War in European cultural history*. Cambridge: Cambridge University Press.

The Genie and the Bottle: Reflections on the Fate of the Geneva Protocol in the United States, 1918–1928

Roy MacLeod

Abstract For Americans serving in the First World War, the advent of chemical weapons made a deep impression. For chemists and soldiers, the experience of meeting—and then making—variants of "poison gas" bred both fear and determination. The wartime creation and post-war struggles of the Chemical Warfare Service reveal the deep divisions these tensions caused, both during the war and through the 1920s, when the United States extensively debated, but failed to ratify, the Geneva Protocol. By the close of the 1920s, the popular optimism that greeted postwar science and invention was clouded by visions of science as a source of new and terrible weapons. In the case of chemical weapons, professional resolve to prepare for future wars competed with a desire to protect the ideals that science represented. In ways that now seem familiar, the profession of chemistry, the chemical industry and the military became powerful allies. This paper examines a subject neglected by historians, and considers how political and professional factors combined to frustrate and delay the early ratification of the Geneva Convention by the United States. As we shall see, our knowledge of these circumstances is far from complete, and will remain so until we have a deeper understanding of the history of America's complex relationship with this toxic legacy.

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B. Friedrich et al. (eds.), *One Hundred Years of Chemical Warfare: Research, Deployment, Consequences*, DOI 10.1007/978-3-319-51664-6_11

1 Introduction[1]

> War is a rough and violent game. Destruction is according to its nature and must be so. Each of the belligerents finds itself in need when facing the foe. And when in need any means are permitted. "Use whatever can be used" is the first law, based on the nature of war —H. L. Gilchrist, 1928.

Thus, Colonel H. L. Gilchrist of the US Army Medical Corps, second chief of the US Chemical Warfare Service (CWS), speaking to the American Chemical Society (ACS) meeting at Chicago in August 1928, almost a decade after the Armistice. Today, the world awaits the resolution of this and many other issues that were left unresolved in 1918 and by the Treaty of Versailles a year later, which together marked what Sellar and Yeatman memorably called "the cause of nowadays" (Sellar and Yeatman 1932). Among these, we must regrettably count the legacy of chemical weapons.

This legacy is today prominent in the Middle East where, in September 2013, the Government of Syria launched a chlorine gas attack on its own population, killing 1,429 people, including 426 children. Since then, the humanitarian tragedy in the Middle East has reached epic proportions. Over 100,000 people have died and the conflict is likely to worsen. Reports of the continued use of chemical weapons reach us almost daily. For over three years, the United States has led in helping to dispose of Syria's declared chemical weapons (CW) stockpile of 1,300 metric tons and to dismantle its 23 CW production facilities, and has overseen (at this writing) the neutralization of 600 metric tons of sarin, VX, and mustard gas—what the US Senate Armed Services Committee has called "the world's worst weapons."[2] But the threat lives on. The United States, with other countries, asks what has become of the vision implicit in the Geneva Protocol of 1925 and its successor, the Chemical Weapons Convention of 1992 (entered into force in 1997), to which 190 states—including Syria—have given their assent? What is the future of the norms that these agreements once inspired, in the attempt to put the "Genie back in the Bottle"?

These questions prompt historians to reflect upon the long history of attempts to control the proliferation of chemical weapons. In so doing, however, we seldom recall the factors surrounding the failure of the United States to ratify the Protocol in 1926. Not until January 22, 1975 did President Gerald Ford, following initiatives

[1]I wish to express my thanks to Dieter Hoffmann and Bretislav Friedrich and to Martin Wolf and Jürgen Renn for bringing an Australian from ANZAC Day in Sydney to join this gathering. I wish also to thank the small but influential group of scholars who have studied the history of the Geneva Protocol, including Hugh Slotten, Gilbert Whittemore, Catherine Jefferson, and above all, Julian Perry Robinson and the staff of the Harvard-Sussex Program, in whose archives I have had the pleasure of working.

I dedicate this essay to the memory of Christopher Freeman, founding director of the Science Policy Research Unit at Sussex University, whose experience of war gave him a special appreciation of the Chemical and Biological Weapons Convention.

[2]US Department of State. Protocol for the Prohibition of the Use in War of Asphyxiating, Poisonous or other Gases, and of Bacteriological Methods of Warfare. Signed at Geneva, June 17, 1925, and entered into force February 8, 1928.

begun a year earlier by President Nixon, sign the instruments of ratification that brought to a close a half-century of discussion. Fifty years earlier, at the Geneva Conference for the Control of the International Trade in Arms, Munitions and Implements of War, the US played a key role in drafting a protocol that was signed by 30 nations, including the US, which prohibited the "use in war of asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices, as well as the use of bacteriological methods of warfare." But the US Senate declined to ratify the protocol, and without a formal vote.

The historian will ask, why? What were the factors that withheld US Government support for a treaty the origins of which reached back as far as the Declaration of St Petersburg in 1868, the Brussels Declaration of 1874, and the Hague Declaration concerning Asphyxiating Gases of 1899—which the United States also failed to ratify—as well as the Hague Convention on Land Warfare of 1907. These prohibited the use of "poison or poisoned weapons" in warfare, a conclusion on which the leading military powers of Europe found agreement.

Our questioning begins with the American experience of the Great War; with the conception, production, and use of chemical weapons by America; and with the implications of "science mobilized" for American industry, the military, and international relations. The subtext reveals a debate that takes place within a web of conflicting interests, in which the United States, emerging from the war as the world's principal creditor nation, declined to participate in the League of Nations. This essay highlights some questions that surround these issues, the pursuit of which unites historians of science, diplomacy, and economic history who seek to understand America's relationship with this toxic legacy of the twentieth century.

2 Science and the Great War

The beginnings of this history are well known. The war began in August 1914 as many had predicted, and soon became a scientific war, for which the Allies were ill prepared. Moral outrage, stirred by the burning of the library at Louvain, the atrocities in Belgium, and the shelling of Rheims, was quickened in October by the "Manifesto of the 93 Intellectuals" (vom Brocke 1985; Ungern-Sternberg 1996; Horne and Kramer 2001).

By November, French scientists were mobilized into munitions work, and by the spring of 1915, Britain had several new research institutions for the War Office and Admiralty (MacLeod 2000, 23–46). The advent of chemical warfare on the Western Front in April 1915 marked a new departure in the application of science to war. The same week that saw the first German use of chlorine gas at Ypres followed by the U-boat sinking of the *Lusitania* saw the beginnings of a new kind of warfare, with dimensions that have disturbed mankind ever since. By 1918, new weapons, tactics, and technologies contributed to Germany's defeat (MacLeod 2009, 37–51). In an age of modern warfare, chemical weapons had become the "new normal."

Until April 6, 1917, the United States remained officially neutral, despite the growing participation of large sections of American industry, in which the disciplines of applied science were quick to take advantage (MacLeod 2014). From this experience emerged several significant features of modernity: a powerful scientific establishment, with lobbies that found their way to Congress; the redesign of international scientific organizations along lines favoring American interests; and an increasingly close relationship with the military, in ways that hinted at the militarization of science itself.

Alongside the many wartime applications of science, chemical weapons were to dominate modern memory (MacLeod and Johnson 2006). But Americans came late to gas warfare, and were not its principal victims. US troops saw their first major engagement at Chateau Thierry only in June 1918, by which time gas weapons—and gas defenses—were already used extensively by both sides. Chlorine and phosgene damaged the unwary, but the arrival of mustard gas, new in 1917, devastated American forces on the Western Front, where inexperience and poor discipline contributed to a higher proportion of gas casualties than suffered by Britain, France, or Germany.[3]

Although the US Army struggled, American chemists had been studying and monitoring the use of gas since 1915, when the American Chemical Society mounted a campaign to enlist chemists into the war effort. As the United States began to turn itself into an arsenal for the Allies, the National Academy of Sciences created a National Research Council (NRC) to extend its wartime mandate. In 1917, the NRC responded to the call of its chairman, the astronomer George Ellery Hale: "I really believe this is the greatest chance we ever had to advance research in America" (Wright 1966, 288). America's official entry into the war in April 1917 gave chemical warfare its mandate.

In America's production of chemical weapons, the Bureau of Mines led the way and, by the end of May 1917, had mobilized 118 chemists from 21 university laboratories, three private companies, and three federal agencies to work at Camp American University (still the site of American University) in Washington, D.C. But the War Department had even bigger plans, and, in September 1917, established a Gas Service in the US Army Engineers under General William Sibert. This was modeled on the Service de Chimique of the French Army, and adopted their gas masks and drill. Following the experience of the German offensive in March 1918, the War Department created an autonomous Chemical Warfare Service (CWS), which it tasked with the full spectrum of research, production, and supply. Initially, much of its work was defensive, and an overseas branch was established under General Amos Fries, who later became the Service's director and advocate. Together, Sibert and Fries developed a substantial program of research and development which, at relatively low cost, set out to bring chemistry to America's defense (Fries and West 1921; Fries 1921). Under Sibert, the CWS began by

[3]Chemical weapons were said to cost Americans 11% of their casualties, versus 5% of the other belligerents. For debate surrounding these figures, see Baxter (2004).

Fig. 1 *Left* Major General William L. Sibert (1860–1935). Watertown Free Public Library; *Right* General Amos Alfred Fries (1873–1963). Creative Commons

developing a close relationship with American industry, and especially with the American Chemical Society, and its myriad membership (Fig. 1).

In September 1917, immediately following Germany's first use of mustard, CWS laboratories began to study its method of production; and by March 1918, the research group led by the young Lt. James B. Conant found an efficient process, sharing the credit with Sir William Pope's group at Cambridge, but producing mustard gas before the British (Whittemore 1975, 151; Jones 1980, 426–440).[4] By the Armistice, America's Edgewood Arsenal was producing 30 tons of mustard gas a day; 35% of the shells fired by American artillery in France were filled with gas; and the strategists of the United States and Britain, including Benedict Crowell at the War Department and Winston Churchill at the Ministry of Munitions, were anticipating its massive use in the great offensive planned for the Spring of 1919 (Crowell and Wilson 1921; MacLeod and Johnson 2006) (Fig. 2).

With the Armistice, the wartime relationship fostered with industrial and academic chemists continued unimpeded. Many compounds were tested, and new gases were in the offing. The CWS was particularly proud of Lewisite, while the British tested a new arsenical, code-named DA, which was capable of penetrating the most effective German gas masks (Jefferson 2014, 654). The CWS recruited

[4]Mustard Gas Warfare: Man who Makes It Tells of Science's Deadliest Weapon and How United States Army Will Use it in Quantities. *New York Times*, July 7, 1918.

Fig. 2 James Bryant Conant (1893–1978), upon becoming President of Harvard University in 1933. Creative Commons

university chemists both to study known problems and to find new problems to solve. The expanding laboratories at Edgewood and Camp American University in Washington, D.C. saw a cross-section of chemists, young and old, academic and industrial (Whittemore 1975, 151).[5] Before the war, George Burrell, chief of the Research Division at Edgewood, had gone no farther with gases than exterminating small animal pests. Lee Lewis, also at Edgewood, was better known for his work on improving the water quality of public swimming pools (Fig. 3).

Robert Williams, who studied the use of ricin from the castor oil plant, a few grains of which can kill a person, went on after the war to synthesize Vitamin B1 (Whittemore 1975, 152). Others, like Yandell Henderson, professor of physiology at Yale, who developed the first successful American gas mask, wrote on gas warfare and aviation for the *Yale Alumni Weekly*. Underlying all this effort was the theme of research as "productive scholarship"—the results of which might not appear for years.

[5]The work of Gerard Fitzgerald on the wartime Edgewood Arsenal promises fresh revelations.

Fig. 3 Winford Lee Lewis (1878–1943), who invented 'Lewisite.' Wikimedia

In April 1918, on the third anniversary of the first use of gas on the Western front, Henderson wrote:

> We must give the devil his due—the Germans have developed to a high degree the research side of science, and that is what has made it possible for the German army to make this drive […] and it is by the use of such scholarship [that] we have got to beat those men over there and drive them back (Henderson 1918).

In September 1919, the first postwar meeting of the British Association for the Advancement of Science looked back to the carnage, and appealed to the conscience of the nation: "Science must receive from man its commission to heal the sores that it has made."[6] Similar sentiments were voiced by Woodrow Wilson, speaking at Versailles in January 1919:

[6]Science in War and After: Good Angel or Evil Genie. *The Sunday Times*, September 10, 1919.

> We must take, so far as we can, a picture of the world into our minds. Is it not a startling circumstance for one thing that the great discoveries of science, that the quiet study of men in laboratories, that the thoughtful developments which have taken place in quiet lecture rooms, have now been turned to the destruction of civilisation? […] The enemy whom we have just overcome had at its seats of learning some of the principal centres of scientific study and discovery, and used them in order to make destruction sudden and complete; and only the watchful, continuous cooperation of men can see to it that science, as well as armed men, is kept within the harness of civilization. (Wilson 1919; Schilling 1964)[7]

In the United States, chemists working for the CWS gave the impression that the Armistice had interrupted their work (MacLeod and Johnson 2006). Their experience translated into proposals for government support and was mapped onto the platform of the Progressive Party and onto the program of "preparedness" that helped define interwar America.

3 The Coming of Geneva

The Treaty of Versailles, signed in November 1919, affirmed the prewar norm and prohibition of poison gases, in an unvarnished attempt to prevent Germany from again producing, importing, or using chemical weapons. Similar provisions were included in treaties that embraced Austria, Hungary, and Bulgaria. But the issue was too important to leave to noble sentiment. The new League of Nations set out to reach a permanent international agreement. In May 1920, the League's Permanent Advisory Commission on Military, Naval and Air Questions (PAC) ruled that the use of gas was no more cruel than the use of any other weapon and was therefore not amenable to prohibition. But the Council of the League declined to accept this argument and, prompted by reports in England that the CWS had developed aerosols to deliver gas by air, referred the issue back to the Permanent Commission. While experts considered what damage airborne attacks might do to civilian cities, the League was asked to debate an outright ban.[8]

In the early 1920s, American governments were both more and less ambitious in thinking about chemical weapons, largely favoring an international agreement, but anxious lest this entail the loss of strategic and economic advantage. In 1921, the question was brought by the Harding administration to the attention of the Washington Conference on the Limitation of Armaments, a committee of which ruled that it was impossible to limit the use of chemical weapons in war, but that it was possible to forbid their use against non-combatants. When this proposition failed to win supporters, the American delegation, led by Secretary of State Charles Evans Hughes, went further and recommended a total prohibition (Fig. 4).

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[7]Woodrow Wilson addressing the Second Plenary Session of the Peace Conference, January 1919. US Department of State, Papers Relating to the Foreign Relations of the United States: The Peace Conference, vol. 3, 179. Washington, D.C.: USGPO, 1942–1947. In Schilling (1964).

[8]See *The Times*, March 15, 1921.

Fig. 4 *Left* Secretary of State Charles Evans Hughes (1862–1948); *Right* Chairman of the Senate Committee on Foreign Relations William Borah (1865–1940). Library of Congress

Hughes' view was supported by a national opinion poll, conducted in the United States for the American delegation, which found a majority of Americans in favor of Article V of what became the Washington Naval Treaty, prohibiting the use of chemical weapons "as justly condemned by the general opinion of the civilized world." Signed by the US, the UK, France, Italy, and Japan, this "Five-Power Treaty" was ratified by the US Senate on March 29, 1922 by a vote of 72–0, with 24 abstentions. Only one Senator—James Wadsworth, Jr. (R–NY), chairman of the Senate Committee on Military Affairs—spoke against it. Because the government of France declined to ratify certain provisions concerning submarines, the treaty failed to enter into force. But the idea had gathered momentum, and the United States was seen to have led the way. This is what Daniel Jones has called the "Lesson of 1922" (Jones, 1980, 428).

This lesson was twofold. The first turned on timing. Only seven weeks separated the signing of the Washington Treaty and its ratification by the Senate. Opponents thus had little time to mobilize. The second turned on domestic politics. In this case,

public opinion had been tested, and found overwhelmingly in favor. Those who opposed had to look for support elsewhere. And this was to come.

For two years, the question slumbered. On September 27, 1924, as Catherine Jefferson has reminded us, the Washington Treaty was brought to the 5th Assembly of the League of Nations, which recommended that a draft convention restricting the use of poison gas be drawn up by its Temporary Mixed Commission on the Reduction of Armaments for submission to member states (Jefferson 2014, 647–661). This discussion, of course, excluded the United States, which remained outside the League. However, when the League convened a Conference for the Supervision of the International Trade in Arms and Ammunition and in Implements of War, President Calvin Coolidge authorized a delegation to be sent, led by Rep. Theodore Burton (1851–1929), chairman of the Foreign Affairs Committee of the House of Representatives, which included Herbert Hoover (Secretary of Commerce) and Frank Kellogg (Secretary of State). This conference met in Geneva on May 4, 1925.

Before the meeting, Theodore Burton, who personally supported a ban, persuaded Coolidge that the United States propose to the Conference a provision forbidding international trade in chemical weapons—in effect, a non-proliferation treaty. The Military and Technical Subcommittee of the Conference, to which this proposal was referred, rejected the idea as unworkable on the grounds that it would unfairly discriminate against weaker states that were unable to make weapons on their own. Given this logic, the British, Polish, and Italian delegates proposed to hold a special conference, the purpose of which would be to consider a treaty to ban all chemical and (at the suggestion of Poland) bacteriological weapons. Despite reservations from Italy and Switzerland, their proposal was accepted and a protocol was appended to the final resolution of the Conference. This became known as the Geneva Protocol, which was signed on June 17, 1925.

The Geneva Protocol restated the prohibitions laid down by the Versailles and Washington treaties, with an additional ban on bacteriological weapons. It made no provision for enforcement, nor did it limit the scope of the prohibition. It banned the "use of weapons," but not the weapons themselves. It was effectively a statement of "no first use." Nothing in the protocol specified inspections or sanctions. The protocol did not prohibit development, production, or stockpiling, nor did it provide for a means of verification. But with these limitations, it did confer a measure of legal and moral condemnation of such weapons across the world.

There were, however, many potential flaws in the provision. If, for example, the Great Powers were signatories but Germany and Japan were not, would the protocol be accepted? And what of the United States? In January 1926, President Coolidge sent the protocol to the US Senate for ratification. Coolidge supported arms control, not least because he believed that as peace was the natural ally of an expanding economy, the United States would surely benefit. In any case, the Five-Power Treaty of 1922 that banned the use of chemical weapons among its signatories had sailed through the Senate without a single negative vote. The Protocol would surely have an equally smooth passage. The administration's submission to the Senate

deleted the controversial submarine clauses and expanded the reach of the ban from five to 41 nations.

This time, however, the government made three fundamental errors. The first was timing. Coolidge signed the Treaty on June 17, but William Borah (R–Idaho), chair of the Senate Foreign Relations Committee and floor manager of the protocol, failed to report the treaty out of committee until a year later, on June 26, 1926. Then, for reasons of timetabling, the debate was not scheduled until December 13, 1926—almost 18 months after the protocol was first introduced. There was ample time for opposing interests to muster (Fig. 5).

Second, the Senate was poorly briefed. When the protocol finally reached the Senate floor, most Senators remained silent, and only five spoke. The issue was not as pressing as other work before the Congress. Worse still, the White House failed to consult and win the support of the War Department and the Navy (McElroy 1991, 131), both of which were disposed towards the treaty. Without their expert backing, the Senate was obliged to look elsewhere for advice. And into this vacuum leapt Senator Wadsworth, chairman of the Senate Committee on Military Affairs, and a spokesman for the Chemical Warfare Service.

Wadsworth opposed ratification, as he had in 1922, on the grounds of "national preparedness." In 1921, Sir Edward Thorpe had told the British Association for the

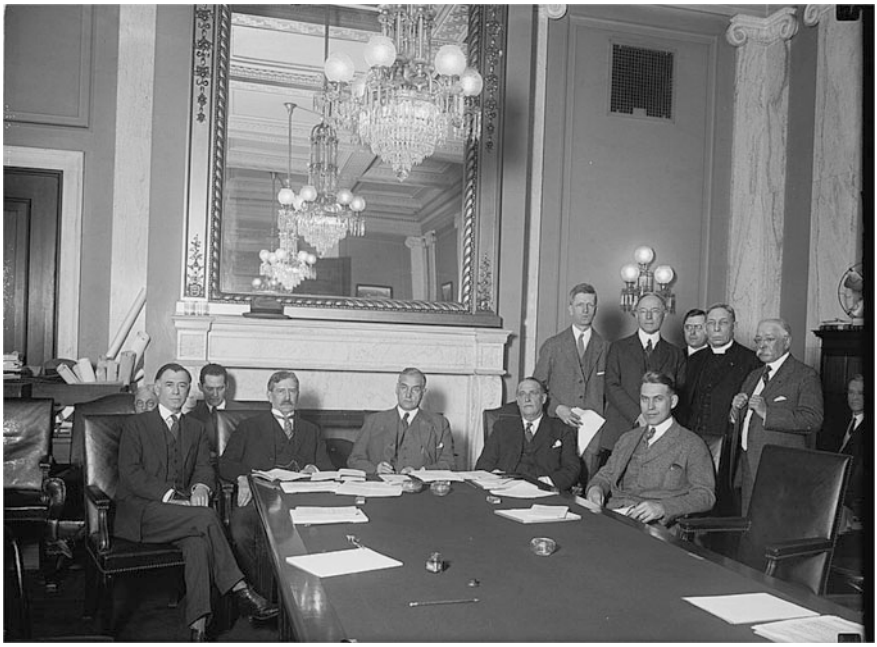

Fig. 5 Senate Foreign Relations Committee, 30 April 1924. Library of Congress

Advancement of Science that the "moral sense of the civilized world is not so dulled but that, if roused, it can make its influence prevail" (Thorpe 1921). But within the next generation, a trope that Woodrow Wilson had popularized took on a new appeal.

As Frances Harbour has shown, a dozen veterans' organizations were now mobilized, sending petitions that supported "preparedness" and rejected the protocol (Harbour 1990). These factions found influential support from the American Chemical Society (ACS), which in 1925 celebrated its 50th anniversary. The ACS was then the largest chemical society in the nation and one of the largest scientific societies in the world. At least 500 of its members had been in the wartime CWS and were devoted to its survival. The future of the CWS was threatened by the coming of peace. But its leaders refused to go quietly into the night and, throughout the 1920s, marshaled commercial support for its research, with applications ranging from agriculture to perfumery (Faith 2008).

In early 1926, Edgar Fahs Smith, who had been chairman of the Chemical Weapons Subcommittee at the 1922 conference, visited Coolidge and spoke against the protocol. Meanwhile, the ACS lobbied all senators, arguing that "all history shows that any effective weapon available will be used" (Harbour 1990, 13). At its national meeting in Los Angeles in August, the ACS repeated the main arguments that framed its agenda: (1) that chemical weapons were effective; and (2) that gas was a less cruel (or, as often put, "humane") alternative to worse weapons. Echoing the defense advanced in *Callinicus* by J. B. S. Haldane, FRS, the British polymath (Haldane 1926),[9] these arguments were buttressed by the campaign for national preparedness, which resisted interference from any foreign power or the League of Nations. Ratification of the protocol, they argued, would force the United States to forego a strategic capability that it had struggled to create (McElroy 1991, 140–150). Secretary of State Kellogg met with representatives of the ACS in November 1926, but failed to secure a compromise.

For months, the question was postponed as the Senate fought over affiliation with the World Court of the League of Nations. Months passed, and it seemed that Kellogg had acquired few allies in the upper house. On December 9, 1926, the first day of debate, the only senator to speak for ratification was William Borah, who quoted General John Pershing:

> Chemical warfare should be abolished among nations as abhorrent to civilisation. It is a cruel, unfair and improper use of science. It is fraught with gravest danger to noncombatants and demoralizing to the better instincts of humanity. (McElroy 1991, 132)

[9]Haldane's title gave it all away: Callinicus, an eighth-century Syrian prince—his name, of Greek origin, means "beautiful victor"—used "Greek fire" to prolong the survival of the Eastern Roman Empire for 750 years.

The emollient intention of Pershing's words was lost on Senator David Reed (R–Penn), who had been an artillery officer during the War:

> Are we, then, to go against an inferior antagonist, with all the abundance of artillery that the World War has left us, to blow out of existence a lot of peasants who scarcely know what the war is about? Or are we to take advantage of this great chemical opportunity which we, as a manufacturing nation, have open to us. Would it not be more merciful, assuming that we were at war with some Central American country, to win our battles by the temporary disabling of our enemies than to blow them all over their cactus plants? (McElroy 1991, 141)

After a weekend break, debate resumed, and three other Senators called for rejection. Senator Ransdell (D–La) championed the ACS and the interests of industrial chemistry and expressed the hope that the protocol be "buried so deep it would never appear before us again" (McElroy 1991, 142). At this point, the Administration saw no hope of winning the required two thirds' vote of the Senate. After three days, the State Department withdrew the protocol without putting it to a vote. Contemporaries could have seen this as a strategic retreat—a retreat that lasted for the next 50 years. But Frederick Brown sees the conclusion as almost inevitable, for two compelling arguments. The United States "could not expect to obey agreed restraints unless they were perceived to be in the national interest." To which Senator Wadsworth added: "it is against all human nature to expect a nation to deny to itself the use of a weapon that will save it" (Brown 1968).[10] The Senate accepted the argument of the CWS that ratification would "stultify if not preclude" readiness for gas warfare; in language which the CWS might have approved, Brown adds, it would be "virtually impossible to allocate scarce resources to increase chemical warfare readiness when the use of gas in war had been prohibited." Preparedness trumped prevention (Fig. 6).

It seems clear that the Senate's de facto rejection of the Geneva Protocol accompanied a shift in American policy away from "in principle" support and towards a precautionary *realpolitik*. As Frederick Brown put it, "From enthusiastic promotion of any treaty which would reduce the possibility of gas warfare in 1921, the United States had become a rather skeptical bystander by 1931" (Brown 1968, 108–109). The protocol remained in the Senate files until 1947, when the then chairman of the Foreign Relations Committee, Arthur Vandenberg, returned it in response to a *pro forma* request from the Truman Administration to process unratified treaties. Even then, historians find no reason to suggest that the protocol's retrieval was any more than a housekeeping measure. In a Cold War of rapid movement in secret chemical and biological weapons development, no American president was likely to show an interest in reviving the subject (Harbour 1990, 20).

[10]Congressional Record, 69th Congress, 2nd Session LXVIII, Part I, 144–149; cited in Brown 1968, 106–107.

Fig. 6 Clockwise from *top left*: David A. Reed (1880–1953); Calvin Coolidge (1872–1933); Frank B. Kellogg (1856–1937); Theodore E. Burton (1851–1929); William Borah (1865–1940); James Walcott Wadsworth Jr. (1877–1952). Creative Commons and Library of Congress

4 A Protocol Post-mortem

Had the Geneva Protocol, in Frances Harbour's phrase, simply "slipped through the cracks"? Or were other factors at work? How can we best summarize the events of 1926?

Following the successful ratification of the Washington Treaty in 1922, Coolidge seems to have been overconfident of a similarly smooth passage in 1926. Evidently, his confidence was misplaced. More important, the Senate debate, when it finally took place, shows all the effects of intervention by the supporters of the CWS. Although the military establishment never liked the CWS, nor had it won special distinction in the field, the Service had friends in both houses of Congress and in the

chemical industry, many of whom, it could be argued, had made fortunes from the war and looked forward to a profitable peace.

From the late 1920s to the early 1930s, the annual budget of the CWS averaged $1.2 million and, in 1934, fell to only $800,000 (Baxter 2004, 77). But these modest figures mask the fact that, throughout the 1920s, under Major General Amos Fries (1920–1929), the CWS opened a new chapter in military affairs, testing a range of weapons and acquiring a reputation for innovation. "Medicine and agriculture have been largely benefitted by the evil genie let loose," one sympathetic journalist commented; "From red currants to pumpkins, no fruit has been discovered that cannot be poison-gassed into extra size and nutritiousness," and CWS posters extolled the new dyes that were coming from its war-related research (Slotton 1990, 493). Public disapproval of chemical weapons was broad but not deep, and no one argued against the economic value of research. In any case, with his record of insecticides and perfumes, General Fries could boldly claim he was actually running a Chemical Peace Service (*ibid*., 492).

A third argument against ratification came from the ACS, which was ambivalent about the implications, if not the intentions, of the protocol. Driven by its wartime experience, the ACS took the side of its chemical colleagues in the CWS, with whom it shared personal and political leanings. In 1918, it was Charles Parsons, Executive Secretary of the ACS and also Chief Chemist of the Bureau of Mines, who with approval reminded the ACS that "War, the destroyer, has been […] the incentive to marvelous chemical development with a speed of accomplishment incomprehensible in normal times" (Slotton 1990, 486).

The contributions of the war, as George Ellery Hale and the NRC foreshadowed, had already opened to Americans a "New World of Science" (Yerkes 1920). In the wake of the war, the American scientific community had acquired unprecedented recognition and public acceptance. With this also came political accountability of a kind that few had so far mastered. Not only in Germany would professional values be overtaken by patriotism when the national interest made it necessary (MacLeod and Johnson 2002, 169–179).

To the general public, the case advanced by the ACS in 1926 reflected a widely held view that chemical weapons constituted a "humane chemistry," distinguishable from the "scientific barbarism" of conventional weapons. In contrast to high explosives, which accounted for most battle casualties on the Western Front, statistics produced by the British army—widely cited but now contested—suggested that only 3% of gas casualties died of their injuries, compared with the 40% of deaths caused by all other weapons. Little was known at the time of the lasting effects of gas, which by Third Ypres in 1917 accounted for 14% of British casualties (McElroy 1991, 140).

All weapons were destructive, but some were more destructive than others, and, it was argued, applications of chemistry (and biology) might at least make war endurable. J. B. S. Haldane made what many thought an overwhelming case for gas defense—and also for preventative offence, such as the CWS advocated—on the grounds that it would serve mankind well, not as a means of preventing war, which was impossible, but as a way of making future wars end quicker. Thus, by making warfare more scientific, science would make war more efficient—shorter, simpler, and less damaging to the social order, if not to humankind.

The Geneva Protocol languished in the absence of a strong will to overcome such arguments. But perhaps there was an even deeper reason. In 1921, Will Irwin's highly popular *The Next War: An Appeal to Common Sense* told the American reading public that the German gas attack in 1915 was as significant as Columbus' discovery of America. As such, it was terrifying. The experience of the War had shown that

> Those great and little scientific minds, engaged hitherto in searching for abstract truth or in multiplying the richness of life and the wealth of nations, could be turned toward the invention of means of destruction whether they wished or no. (Irwin 1921, 28)

Irwin cited wartime rumors that a dozen bomb-loads of lewisite could destroy the population of Berlin. If so, poison gas "of a power beyond the dream of a madman, seems to be the killing weapon of the future" (Irwin 1921). The protocol contained no provisions for enforcement. Kellogg said that the United States, in ratifying the protocol, would have to depend upon the "good faith of nations." But why should the United States risk losing the future?

There was also an absence of domestic political pressure. Reportedly, there was less protest in the United States at Germany's first use of gas in France than at the loss of American life on the *Lusitania*. And when, in 1918, the US Army began to use gas of its own making, there was little domestic opposition. As Hugh Slotten has found, the *New York Times* surmised that gas had inevitably "been forced upon all the combatants by the custom of the Germans," whilst other newspapers, including the *Washington Post*, the *San Francisco Chronicle* and the *New York Tribune*, did not comment at all (Slotton 1990, 485).

If a majority of Americans were opposed to the use of chemical weapons—and surveys suggested they might be—they were also in favor of being "prepared," which ratification of the Geneva Protocol seemed to override. In the absence of infallible military expertise or domestic political pressure, the floor of the Senate was no place to rally public opinion that had found no great reason to protest.

5 Summing up the Senate

Historians may point to several possible reasons for the US Senate's failure to ratify the Geneva Protocol in 1926. They may include:

1. a lack of strategic planning by the Coolidge Administration, producing a costly delay;
2. an unenthusiastic handling of the protocol on the Senate floor, revealing no coherent strategy for securing ratification; in his annual State of the Union Address, delivered only two days before the Senate debate, President Coolidge failed even to mention the protocol;
3. a failure to mobilize public opinion in support of passage at precisely the time it was needed;
4. a failure to counteract the influence wielded by a confederation led by a Chemical Weapons Service that was fighting for its life;
5. a lack of confidence that the protocol would accomplish its goal; and
6. a failure on the part of the State Department, which neglected to consult with the Army and the Navy.

In the Senate's failure to ratify the protocol, many such factors may have been necessary, but perhaps not sufficient. What surfaces above all else from the Congressional Record is the way in which the protocol suffered from an almost seamless transition from a national narrative of disarmament to a discourse of deterrence. We now see its limitations and imperfections. We accept that the protocol was essentially a no-first-use provision. It prohibited the use of gas, but permitted states to research and reserve the right to retaliate in kind. Even when the US did ratify it in 1975, the protocol did not prohibit development, production, or stockpiling; nor did it specify means of verification. It failed to provide a mechanism for collective response. In this, it illuminated some of the security failures of both the League of Nations and the United Nations (Fig. 7, 8).

To remedy these limitations, the world had to wait for the Chemical Weapons Convention in 1993 (entering into force in 1997), which prohibited the production and use of chemical weapons, provided for the destruction of production facilities (or their monitored conversion to other functions), the destruction of all chemical weapons (including chemical weapons abandoned outside state parties' territory), an inspection regime for the production of chemicals that could be converted to chemical weapons, and international cooperation in the peaceful uses of chemistry.

SAYS AMERICA LAGS IN WAR GAS RACE

Chemical Expert Declares That Arm of Service Is Treated Like a Stepchild.

ONE MASK TO 100 SOLDIERS

Points to Activity in Germany, England, Japan and Even in Latin Republics.

Germany and other European nations, including those of Latin America, are forging ahead in chemical warfare, while the United States is falling behind, according to Dr. Harrison E. Howe, member of the American Chemical Society.

"In this country we have only one modern gas mask per hundred enlisted men in the regular army and National Guard," said Dr. Howe, quoting the reported statement that "Germany has stored, ready for use, sufficient modern gas masks to provide five for every soldier authorized by the Treaty of Versailles."

It is plain that "though the ascendency of chemical warfare is written everywhere, the United States Chemical Warfare Service is being treated as a stepchild by those in charge of army appropriations."

Should war come our troops would be required to fight the first six months inadequately protected, said Dr. Howe.

"Italy, shortly after Mussolini came into power, established a chemical warfare service modeled along the lines of our organization but with twice the number of officers," he went on. "England appears to be giving chemical warfare the same importance as its three great arms of national defense—Army, Navy and Air Service.

Fig. 7 *New York Times*, 8 March 1925, p. 26

"Chemical warfare has been placed under a committee headed alternately by a high ranking officer of the army and navy. Russia, like England, has placed chemical warfare on the same plane with other important branches of her service.

"Japan has shown great activity along chemical warfare lines, and it is stated that four divisions of troops have been abolished so that the funds thus made available can be spent on the air service and the chemical warfare service.

"Japan has been buying large quantities of chemical warfare supplies from Germany and elsewhere, and is known to be availing herself of the services of the ablest scientists from the German chemical field.

"France is perhaps as well prepared to use chemical weapons in war as any other nation, though less is known about her plans and actions than any of the other powers. Spain, Switzerland, Poland, Czechoslovakia, Sweden, all have chemical warfare service in one form or another, and it will be recalled that Spain used gas against the Moors in one of her campaigns last year. Even Mexico and certain countries in South and Central America are showing a growing interest in chemical warfare.

"Meanwhile, we spend $1,347,580 to feed the 9,230 horses in the cavalry and at the ration allowed for horses—40 cents per day—the 45,000 horses and mules in the entire army cost $6,570,000 for forage alone, not to mention housing, harness, caretakers and replacements.

"There are 122 veterinary officers in the army's latest directory of Jan. 1, 1925, and there are 83 officers in the Chemical Warfare Service. The extent to which cavalry has been superseded in modern warfare was well demonstrated by the World War. The ascendency of chemical warfare is written everywhere."

Fig. 7 (continued)

CHEMISTS DISAGREE ON FUTURE OF WAR

Inventor of 'Lewisite' Tells Illinois Gathering Gas and Planes Will Dominate.

ARMY MEN SEE LESS CHANGE

Smoke Screen Demonstration by Aircraft Precedes Statement That Science Aids Peace.

Special to The New York Times.

EVANSTON, Ill., Aug. 18.—Science is the ally of peace, declared Dr. W. Lee Lewis, inventor of "Lewisite," one of the most potent gases used in the World War, tonight at the closing conference of the American Chemical Society Institute at Northwestern University.

The statement came just after army airplanes had covered the North Shore with a smoke screen in a few minutes as a demonstration of the new technique of warfare and army men had lauded the new applications of science in developing greater military action.

"If science served warfare only, it would indeed be a human curse," said Dr. Lewis in his address that closed the national defense day program of the institute, cooperating with the National Association of Chemical Defense.

"Even as applied specifically to warfare science makes for peace because it gives the balance of power to the more intelligent and advanced race.

Air Strength Not Controllable.

"The tangible instruments of war such as are controllable by agreement will undoubtedly play a smaller part in future warfare than the less tangible. Battleships and fortresses will be less potent agents than airplanes and chemicals.

"The air strength of a nation is not controllable. It depends purely upon the extent of peace time support of aviation and its commercial development. There is less difference between a commercial airplane and a fighting airplane than there is between a merchantman and a battleship.

"A fleet of commercial planes could be converted into bombing planes in a few hours. There is little difference between a peacetime chemical plant and a wartime chemical plant so far as equipment and procedure are concerned.

"Science does make war less adventuresome, less romantic and more deadly. It is, therefore, fundamentally an ally of peace. There is little of the joust, the tournament in long range guns, submarines and poison gas."

Colonel H. L. Gilchrist of the Army Medical Corps, predicted that the next war would be one of gas attack primarily.

Changes Hard to Foresee Now.

"War at its best," he said, "is a rough and violent game. Destruction is according to its nature and must be so; otherwise, it would not be war. Each of the belligerents finds its self in need when facing the foe. And when in need any means are permitted. 'Use whatever can be used' is the first law, based on the nature of war.

"Just as the World War assumed forms which no man had foreseen in times of peace, no one can today with certainty foretell what form war in the future will take. One thing, however, does seem certain; technical skill, physics and chemistry will be used more intensively than heretofore. Toxic gases in particular will play an almost decisive part. Such being the case, our methods of defense must keep fully abreast of the rapid strides made in offense."

Dr. J. E. Mills, chief chemist of the Chemical Warfare Service of the army, was inclined to look upon the possibilities of gas attacks on civilian population less seriously.

Gas attacks against a city, it was explained, can be rendered relatively ineffective for many reasons, among which the following were cited:

"Gas cannot travel up wind; any ordinary room with doors and windows closed will shut out most of the gas for a considerable period of time."

Calls Cold Steel Still Decisive.

Major Gen. Paul B. Malone, who fought at Verdun and Chateau Thierry, and is now stationed in the Sixth Corps Area, made the point that neither air nor gas warfare will eliminate or decrease the value of other branches of the military service.

"In view of the possibility of transporting airplanes on airplane carriers across the sea, it becomes evident that the defeat of our fleet upon either ocean will place the guns of a victorious fleet within range of our harbors and bring the territory of an overseas enemy into juxtaposition with our mainland. Such a result would make the interior of our country accessible to hostile airplanes.

"Battles in the sky will assume a magnitude scarcely dreamed of during the World War, but these battles in the sky will not be decisive. The infantry and the field artillery, the cavalry, the engineers and all other branches of the service, but slightly affected by this character of warfare, will move forth as they always have in the past to decide the issue upon the battlefields of the world.

"Machinery will enter into and render more complex the conduct of war, but machinery will never re-

The New York Times
Published: August 19, 1928

Fig. 8 *New York Times*, 19 August 1928, p. 23

6 Conclusion

The failure of the US Senate to ratify the Geneva Protocol reflected contrary imaginations and vested interests in the American military, industry, science, and perhaps in public opinion as well. We are accustomed to seeing the protocol as a milestone in the establishment of a diplomatic and moral norm of lasting importance. However, the circumstances of 1925–26 were significant in themselves, having wider consequences that accompanied and foreshadowed deeper conflicts. In particular, we can see—and not just between the lines—evidence of a will to power shown by the natural sciences—the "new bosses of war," as one commentator put it (Slotton 1990, 494). The war had demonstrated a new-found sense of national commitment among American scientists; in the post-war world, the question was how best to "boss" the business of war-related science. Some wanted to keep chemical weapons research under the civilian administration of the Bureau of Mines. But the advantages of a closer connection with the military were clear. The precedent set by the debate would not be lost on those planning atomic weapons research after the Second World War. The protocol debate anticipated by 35 years President Eisenhower's warnings that public policy could become the "captive of a scientific-technological elite" (Jones 1980, 439).

The early 1920s offered reason for both hope and fear—the twin legacies of the Enlightenment. The emerging relationship between science and the military weighed heavily on the conscience of those who, like J.D. Bernal, saw in the outcome of the protocol debate fresh cause to re-examine the politics of science. He and others were inspired to argue that, if science was to have a future, it must show social responsibility—a theme that gained prominence during and after the Great Depression of the 1930s. How rival nations would in future justify their use of the "worst weapon" would take on new definition, and its uses would soon occupy new spaces outside Europe and North America, in Asia, Africa, and the Middle East. But that is another story, for another time.

References

Baxter, William. 2004. *The Chemical Warfare Service of the United States Army during the Inter-War Period*. MA Thesis, Texas Tech University.

Brophy, Leo P., Wyndham D. Miles, and Rexmond C. Cochrane. 1988. *The Chemical Warfare Service: From Laboratory to Field*.In the United States Army in World War II, *The Technical Services*. Washington, D.C: Center of Military History, United States Army.

Brown, Frederick J. 1968. *Chemical Warfare: A Study in Restraints*. Princeton: Princeton University Press.

Gilchrist, H. L. 1928. Chemists Disagree on Future of War. *New York Times*, August 19.

Crowell, Benedict and Robert Forrest Wilson. 1921. *The Armies of Industry, I: Our Nation's Manufacture of Munitions for a World in Arms, 1917–1918*. New Haven: Yale University Press.

Faith, Thomas Iain. 2008. *Under a Green Sea: The US Chemical Warfare Service, 1917–1929*. Ph. D. dissertation, George Washington University.
Fries, Amos A., and Clarence J. West. 1921. *Chemical Warfare*. New York: McGraw Hill.
Fries, Amos A. 1919, Digital Edition 2013. *History of the Chemical Warfare Service in France* http://cgsc.contentdm.oclc.org/cdm/ref/collection/p4013coll7/id/886.
Fries, Amos A. 1921. The Future of Poison Gas. *Current History* 15: 419–422.
Harbour, Frances. 1990. *Chemical Arms Control: The United States and the Geneva Protocol of 1925*. New York: Carnegie Council on Ethics and International Affairs.
Haldane, J.B.S. 1926. *Callinicus: A Defense of Chemical Warfare*. London: Routledge.
Hanna, Martha. 1996. *The Mobilization of Intellect: French Scholars and Writers during the Great War*. Cambridge, MA: Harvard University Press.
Henderson, Yandell. 1918. Gas Warfare and Aviation: The Problems of Productive Scholarship Growing Out of the Present War. *Yale Alumni Weekly.*
Horne, John, and Alan Kramer. 2001. *German Atrocities: A History of Denial*. New Haven: Yale University Press.
Irwin, Will. 1921. *The Next War: An Appeal to Common Sense*. New York: E. P. Dutton.
Jefferson, Catherine. 2014. Origins of the Norm against Chemical Weapons. *International Affairs* 90 (3): 647–661.
Jones, Daniel P. 1980. American Chemists and the Geneva Protocol. *Isis* 71 (3): 426–440.
Kevles, Daniel. 1978. *The Physicists: The History of a Scientific Community in America*. New York: Knopf.
MacLeod, Roy. 2000. Sight and Sound on the Western Front: Surveyors, Scientists and the 'Battlefield Laboratory', 1915–1918. *War and Society* 18 (1): 23–46.
MacLeod, Roy, and Jeffrey Johnson. 2002. War Work and Scientific Self-Image: Pursuing Comparative Perspectives on German and Allied Scientists in the Great War. In Vom Brocke, Bernhard ed.*Wissenschaften und Wissenschaftspolitik: Bestandsaufnahmen zu Formationen, Brüchen und Kontinuitäten im Deutschland des 20 Jahrhunderts*. Berlin: Akademie-Verlag, 169–179.
MacLeod, Roy, and Jeffrey Johnson. 2006. The War the Victors Lost: The Dilemmas of Chemical Disarmament, 1919–1926. In *Frontline and Factory: Perspectives on the Chemical Industry at War, 1914–1924*, ed. Roy MacLeod, and Jeffrey Johnson. Dordrecht: Springer.
MacLeod, Roy. 2009. The Scientists Go to War: Revisiting Precept and Practice, 1914–1919. *Journal of War and Culture Studies* 2 (1): 37–51.
MacLeod, Roy. 2014. Scientists. In *Cambridge History of the First World War*, Vol. 2, ed. Jay Winter, 434–459, 704–708. Cambridge: Cambridge University Press.
McElroy, Rodney J. 1991. The Geneva Protocol of 1925. In *The Politics of Arms Control Treaty Ratification*, eds. Michael Krepon, and Dan Caldwell, 125–166. New York: St Martin's Press.
Russell, Edmund. 2001. *War and Nature: Fighting Humans and Insects with Chemicals from World War I to Silent Spring*. New York: Cambridge University Press.
Sellar, C., and R.J. Yeatman. 1932. *1066 And All That: A Memorable History of England*. London: Methuen.
Schilling, Warner R. 1964. Scientists, Foreign Policy and Politics. In *Scientists and National Policy-Making,* eds. Robert Gilpin, and Christopher Wright. New York: Columbia University Press; and *The American Political Science Review*, LVI (2): 287–300.
Slotton, Hugh R. 1990. Humane Chemistry or Scientific Barbarism? American Responses to World War I Poison Gas. *Journal of American History* 77 (2): 476–498.
Thorpe, Sir Edward. 1921. Presidential Address, *Report of the British Association for the Advancement of Science*, Edinburgh, 23.
Ungern-Sternberg, Jürgen and Wolfgang von. 1996. *Der Aufruf 'An die Kulturwelt': Das Manifest der 93 und die Anfänge der Kriegspropaganda im Ersten Weltkrieg*. Stuttgart: Frank Steiner.
Vom Brocke, Bernhard. 1985. 'Wissenschaft und Militarismus: Der Aufruf der 93 An die Kulturwelt und der Zusammenbruch der Internationalen Gelehrtenrepublik im Ersten Weltkrieg'. In *Wilamowitz nach 50 Jahren,* eds. William M. Calder, Hellmut Flashar, and Theodor Lindken. Darmstadt: Wissenschaftliche Buchgesellschaft. 647–719.

West, Clarence J. 1920. The Chemical Warfare Service. In *The New World of Science: Its Development During the War*, ed. Robert M. Yerkes. New York: Century Company.
Whittemore, Gilbert Jr. 1975. Poison Gas Research and the Ideals of American Chemists. *Social Studies of Science* 5 (2): 135–163.
Wright, Helen. 1966. *Explorer of the Universe: A Biography of George Ellery Hale Woodbury*. New York: American Institute of Physics.
Yerkes, Robert M. (ed.). 1920. *The New World of Science: Its Development during the War*. New York: Century Company.

The Soldier's Body in Gas Warfare: Trauma, Illness, *Rentennot*, 1915–1933

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Abstract The paper describes medical and psychological aspects of gas warfare 1915–1918. It is shown that exact knowledge such as lethal dosages and the type and extent of injuries had been observed in cases of accident long before the outbreak of war. Nevertheless, detailed toxicological research was carried out in the toxicological department of Fritz Haber's Kaiser Wilhelm Institute for Physical Chemistry in Berlin-Dahlem. War itself offered the opportunity for deadly field experiments. The soldiers suffered not only from physical injuries (chest pain, breathlessness, coughing, bloody sputum, multiple organ failure) but also from fear and traumatization. Given the enormous fear caused by the idea of a supposed poisoning even without symptoms, distinguishing the real and actual from the simulated in such cases must have been problematic and caused a permanent threat of being accused of malingering or even simulating. From there it was only a small step to psychic and political stigmatization as "*Rentenbetrüger*" (pension fraudsters) or being mentally ill in the late Weimar Republic and especially under National Socialism. Whereas the nation was forever grateful to the war-wounded and disabled veterans, the stigmatized were seen as being mentally ill, were sterilized, and sometimes even murdered.

1 Introduction

If the First World War may be understood as the first technical and industrial war, then this implicit metaphor not only carries with it the technical aspect of weaponry in the sense of modernity in technology, both with regard to fighting with new weapons and to their development, and further to modern industrial production under the conditions of Taylorism and streamlining of production. The soldiers themselves, too, understood the new war as a kind of industrial work, which was even reflected in their language. One "went to work" in the trenches much as in the

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B. Friedrich et al. (eds.), *One Hundred Years of Chemical Warfare: Research, Deployment, Consequences*, DOI 10.1007/978-3-319-51664-6_12

mineshafts of the Ruhr, to change places with the exhausted men of the previous shift; there was at least as much "work" on the battlefield as in a Krupp factory hall. In sweaty cooperation and collaboration and under the pressure of an unstoppable, urgent timing cycle one became, as an artilleryman or ammunition carrier, as much a part of the mechanical processes of this huge, monstrous death machine as of those of a sheet metal factory at home. The only difference was that one created technical value as a dependent employee there, but on the front one destroyed technical mass products—and with these human lives—in great masses in paid work quite dependent on commands and orders (Eckart 2014).

The most depressing aspect, probably, of the technical and industrial modernity of the Great War was the chemical warfare, which particularly reveals the interlinkage of medical and military technology (Gradmann 2003, 131–154). Gas, as a substance of mass application and well-known toxicity, was in a great variety of forms already present at the start of the war as a waste product of the chemical industry, particularly of the I.G. Farben (Roth 2009, 6–8). Its usability was increased during the course of the war by the innovative synthesis of ever more murderous new substances. In particular, scientists had learnt, long before the war, how to liquefy gas by using high pressure, thus making it feasible to store and transport it in large quantities. As concerns the effect of chemicals on the human organism, most of this information was already known and available owing to industrial accidents.

The development and use of poison gas as a weapon definitely required medical and pharmacological knowledge, which all industrial countries involved in the war had to a greater or lesser extent; the German side had particularly good knowledge in this regard, owing to a high level of development in the chemical industry. The knowledge of the physiological effects of most poison gas types was based not only on animal experiments, but also on the industrial accidents mentioned above.

In the course of animal experiments, exact knowledge was gathered, such as the lethal dosage and the type and extent of injuries, which matched exactly what had been observed in accident cases, for example in the chemical industry. Without such knowledge, the development of new poison gases and their use would have been unthinkable. In addition, there was the fact that the use of poison gas had been anticipated, not only in the genre of technical science fiction (as we would now say) from Jules Verne to Arthur Conan Doyle. In Paris in 1911, for example, ethyl bromoacetate (more precisely: ethyl 2-bromoacetate) was used in the fight against crime, in the form of "tear gas" in cases of robbery. The reason that the use of gas and other chemicals in warfare could become the metaphor par excellence for modern, technical-industrial war cannot be established in the comparatively slight extent of direct effects. Among the roughly ten million war dead, conservative estimates placed the number of deaths through poison gas at "only" 90,000 to

100,000.[1] Among the permanently wounded and damaged soldiers, some 25 million on all sides, there were "only" about one million suffering from the effects of gas. Of considerable significance, however, was the horror of gas, to which not only the expected damage understandably contributed, but also the omnipresent possibility of its use, the ubiquitous way it spread in the area of battle, and the realization that even gas masks and protective clothing could not sufficiently guarantee the survival of man and beast.

A borderline between research serving the development of weapons and that serving to protect against them and to provide therapy for wounds could hardly be drawn. The use of poison gas against the enemy and the protection of one's own soldiers against enemy (or "friendly") poison gas were based on the same research. Fritz Haber's Kaiser Wilhelm Institute for Physical Chemistry in Berlin-Dahlem,[2] where research on poison gas was carried out, consequently had, from 1916, a rapidly growing Toxicological Department. The German army, which was the first to apply poison gas in April 1915, was far ahead of the enemy for this reason, not only as far as research into the gas weapon was concerned, but also in medical care in this area. In military tactics, poison gas extended the scenario of a possible threat and injury to soldiers to new territory, which was purposefully investigated by the medical experts: the effect of extreme terror, which was raised to a benchmark in the further development of this weapon (Kästner and Hahn 1994, 42–50; see also: Zeidler 1993). To say, however, that the effect of poison gas was "mostly a terrifying one," as the pathologist Otto Muntsch described it in 1935 (Muntsch 1935, 102), was pure cynicism. Poison gas injured the body on the outside to a limited extent at first, but it could gradually destroy a soldier's body within hours, days, or weeks. The symptoms were agonizing, terrifying, and, under some circumstances, could occur long after the actual poisoning had taken place. Above all, gas led directly to a large number of soldiers being unable to function. At the same time, gas spatialized the threat of bodily harm, and in place of a specific threat to the body from projectiles, there was that of a deadly environment, inimical to life. The hopes nourished by this, not only among the army, were quite clear. Whole sections of the front could be made to collapse, rapid gains in territory and finally the abolition of the exhausting trench war could be achieved. That these hopes would turn out to be illusory was not at all clear at the beginning of gas warfare, as there were some very quick surprise successes at the start. With the increasing use of poison gas, however, came the disillusionment, at the latest from the summer of 1915 onward. The hopes placed in the effects of this new type of warfare dissolved as fast as the substances being used. One exception was formed by chemical contact poisons and skin-damaging substances, such as mustard gas (actually a nitrogen mustard).

[1]Figures differ very much. For the Western war theatre losses (killed and severely wounded) it seems as if about 20,000 soldiers died and about 500,000 were wounded under gas attacks. For the Eastern front there are no reliable figures. All in all the number of soldiers killed under the influence of poisoned gas may be estimated at about 100,000 (Haber 1986, 243; Müller 2003, 519–522; Gaskrieg während des Ersten Weltkrieges).

[2]See particularly Szöllösi-Janze (1998).

Against this background, it is understandable that substances like these were under consideration for future wars, in order to avoid the costly stalemate of the trenches, as Fritz Haber lectured officers of the Reichswehr in 1920. Only a massive bombardment with sulphur mustard would be suitable

> to make an area with its protective constructions impossible to hold. This chemical weapon forces the abandonment of trench warfare, which the development of explosive munitions had brought with it (in Brauch 1982).

In fact, the main reason was to fill the expected gap in munitions production, as Germany had been cut off by sea blockade from the import of Chilean saltpetre—at that time still an absolute necessity for the manufacture of explosives—already a few weeks after the start of the war.[3] During the war, quite different types of gas and chemical substances were used. The sheer variety was so disturbingly great in the end that Oskar Minkowski, writing in 1921 in reminiscence, was forced to come to the conclusion that

> [t]he number of substances used by both sides in gas warfare had, with time, become a very large one. As the composition of the chemical compounds used by one side could be rapidly discovered and imitated by the other side, while on the other hand damage frequently occurred on both sides from their own gas ammunition, one cannot sensibly carry out any sort of differentiation between the substances used by any one army (Minkowski 1921, 346).[4]

In principle, of course, such a differentiation was clearly possible, at least according to the chemical groups involved. Thus, eye irritants were used, such as the tear gas ethyl bromoacetate (known technically sometimes as *White Cross*, because of the container marking), with rather limited success. More effective were the diverse irritants of the nasal membranes and the throat, known in German as Blue Cross, of which the best known are Clark I and Clark II. These had the aim of irritating the enemy's nose, throat and bronchial areas. These substances were used as "mask breakers" (Minkowski 1921; Gradmann 2003, 145). The strong irritation (hefty coughing, tearing eyes, headache, nausea, vomiting, trembling, and vertigo) would, it was rightly hoped, cause the soldiers to tear their gas masks off, thus exposing themselves completely to deadly gases. To this exact end, lung damaging and asphyxiating poison gases (Green Cross), such as chlorine, chloropicrin, diphosgene, or phosgene, were used. Their aim was the rapid killing of the enemy. While at first great hopes were placed in relying on blowing chlorine gas towards the enemy, the problem of prevailing winds in the right direction being needed, coupled with local microclimatic oddities, soon forced the military to abandon this

[3] See also Baumann (2011).

[4] Translated from the German original: "Die Zahl der von beiden Seiten beim Gaskampf verwendeten Stoffe war im Laufe der Zeit eine sehr große geworden. Da die Beschaffenheit der von einer Seite benutzten chemischen Verbindungen vom Gegner sehr bald ermittelt und nachgeahmt wurde, andererseits auf jeder Seite auch Schädigungen durch die eigene Gasmunition nicht selten vorkamen, kann eine Trennung der von den einzelnen Heeren verwendeten Stoffe nicht durchgeführt werden."

method. It was better to use special gas grenades, in this way shooting the gas, for instance phosgene, at the enemy (Minkowski 1921; Gradmann 2003, 141). Whereas chlorine gas disabled the soldier by means of strong irritation of the mucous membranes, thus the eyes, the nose, the nasopharyngeal zone and the respiratory tract, accompanied by lasting damage to the lung tissue, the hope with phosgene was the rapid dispatch of the enemy by lung oedema. Powerful chest pain, breathlessness, coughing, and bloody sputum were the harbingers of the soldier's death. Multiple organ failure then led to the actual death, either still on the battlefield or, at the latest, in the field hospitals near the front. Under the term Yellow Cross, finally, all those substances were subsumed that cause dermal injury, such as mustard gas and lewisite. In this case, the military goal was to disable the enemy by means of the nearly immediate pain following contact, and the long-lasting injury and extended treatment times. The substances of the Yellow Cross group were also shot at the enemy in grenades, in their oily pure form, or sprayed as aerosols. The expected effect on the body of the soldier consisted in the destruction of the dermal tissue by blistering and the formation of ulcerous areas, or in irreversible blindness in the case of eye contact. In cases of large-scale surface skin contact, or longer-lasting aerosol exposure, such substances could also prove themselves to be rapidly fatal.

It was clear from the start to the German side, and especially after phosgene and Yellow Cross (mustard gas) were ready to be used, that a very difficult situation would arise, should the enemy come into possession, for example, of phosgene, which had been used by the Germans from July 1917. For this case, and in view of the chemical war's intensification through 1918, preparations were made. In January 1918, the medical department of the Ministry of War published a 55-page white paper, entitled "Zur Kenntnis und Therapie der Gasvergiftungen" (On the knowledge and therapy of gas poisoning), which dealt in particular detail with phosgene and mustard gas poisoning. A first addition, published in May 1918, gives an impression of the problems resulting from the escalation of gas warfare, without any mention of enemy use of mustard gas. Apparently there were not enough correspondingly trained medical personnel. This is at least indicated by the instruction to keep such personnel, once trained, at the gas hospital (Eckart 2014, 79–80).

2 Perceptions in the Field

Fritz Haber had, at the beginning, relied on blowing chlorine gas out of pressurized bottles. The first mass use of this deadly poison gas was at his suggestion on 22 April 1915. In this case, success was immense, with massive enemy losses, although the exact number is still debated. The French general Henri Mordacq reported in horror on the gas attack near Ypres on 22 April 1915:

> On the banks of the canal, only some yellowish wisps of smoke could be recognised, but as we approached, via Boesinghe, some three or four hundred meters closer, we felt a hefty

> tingling in our noses and throats, our ears buzzed, it became difficult to breathe; an intolerable stench of chlorine surrounded us. Soon we had to dismount, because the horses, bothered and affected by this, refused to gallop or trot […] Near the village, the scene that we saw was more than pitiable; it was tragic. Men fleeing everywhere: infantry, Africans, riflemen, Zouaves (light infantry), artillerymen without weapons, deranged, coats off or open wide, neckbands torn off, ran like madmen into the unknown, screaming loudly for water, spitting blood; some rolled around on the ground and tried in vain to breathe. (Hanslian 1934, 44)[5]

In Germany, this success was celebrated as "Day of Ypres," in analogy to the "Day of Sedan." But the use of pressurized gas bottles was dependent on the wind, and thus very dangerous for the German troops, too. It was primarily for this reason that the chemist Walter Nernst preferred "gas bombardment" with artillery grenades (Eckart 2014, 80). In February 1916, indeed, for the first time phosgene grenades were fired from the French side, which caused the High Command to finally make new arrangements. In consequence, blowing gas out of pressurized bottles was abandoned, and replaced by bombardment with larger gas containers at shorter ranges, and smaller ones at longer ranges. Now the grenades contained the highly effective substance diphosgene. The grenades, marked in green (Green Cross), were used for the first time on 22 and 23 June near Verdun and caused massive losses on the opposing side (ibid.). Phosgene and especially diphosgene were much more destructive than chlorine gas. Both sides were affected. The physician Alfred Schroth reported in 1917 on such a phosgene gas attack:

> All those cases, however, that we lose through death two or three hours after the attack on the position show a sight of the greatest horror. Breathlessness and coughing increase to asphyxiation. The sputum, at first not much and thick, is replaced by a liquid and then foamy expectoration, which slowly is coloured by blood, and finally oozes out of the nose. The appearance of the poisoned victim is wasted, and as a consequence of the lung oedema, death occurs with the victim nearly completely conscious (Brauch 1982, 70).

Simulation of illness after gas attacks became a particular problem for the German prosecution of the war. This is quite in keeping with the hysteria of the army command with regard to an increase in simulants in this area of warfare, since the army command had already been dramatically confronted with this problem in connection with war neuroses (Gaupp 1922, 71).

[5]Translated from the German original: "Man konnte am Ufer des Kanals nur noch einige gelbliche Rauchschwaden erkennen, als wir uns aber Boesinghe auf drei oder vierhundert Meter genähert hatten, fühlten wir heftiges Prickeln in der Nase und Kehle, in den Ohren sauste es, das Atmen fiel uns schwer; ein unerträglicher Chlorgeruch umgab uns. Wir mußten bald absitzen, da die dadurch belästigten und behinderten Pferde sich weigerten zu galoppieren oder zu traben. »[…] "In der Nähe des Dorfes war das Bild, das sich uns bot, mehr als bedauernswert, es war tragisch. Überall Flüchtende: Landswehrleute, Afrikaner, Schützen, Zuaven, Artilleristen ohne Waffe, verstört, mit ausgezogenen oder weit geöffneten Röcken, abgenommener Halsbinde liefen wie Wahnsinnige ins Ungewisse, verlangten laut schreiend nach Wasser, spuckten Blut, einige wälzten sich sogar am Boden und versuchten vergeblich, Luft zu schöpfen."

At the same time, there are indications of disciplinary problems caused by allegedly or actually pretended or faked gas injuries. These were described in analogy to the war neuroses:

> When the physician at the front has not himself established gas poisoning or the consequences of being buried by a shell in men who complain of this, and whom he feels himself compelled to send back to the rear, then the wounded slip or the paper must have the annotation 'allegedly'. Instead of the very certain designation 'gas poisoning' or 'nervous shock through burial', which leads in such cases to the patient having a permanent notion of serious illness, it is better to note down 'complaints (sic), allegedly following gas poisoning' or 'nervous complaints, allegedly burial'. Keeping men on the battlefield […] is [absolutely] necessary.[6]

A directive of the head of field hospitals of November 1917 was renewed, ordering that the "many soldiers reporting alleged gas poisoning, but not showing immediate signs of illness" be kept directly near the front for 24–48 h, which corresponds to the phase of acute danger in the symptoms of phosgene poisoning (ibid.).

With regard to the assumed simulation of mustard gas poisoning there were similar panicky reactions, although somewhat later. In June the High Command pointed out that the "difficulty in immediately recognizing mustard gas poisoning in those affected […] aided shirking," in that it at least enabled the supposedly poisoned soldier to receive the 24-hour observation time. In the autumn of 1918, additional reports appeared on the simulation of such poisoning, or more exactly its symptoms on the part of soldiers. Thus, in a report from a collecting point for wounded, dated October 1, 1918:

> Over the last few days, three cases of self-inflicted injury in the form of acetic acid burns have been established here without any doubt. Cloths soaked in acetic acid are placed on the skin of the lower arms and legs (ankles) and cause characteristic changes of the skin. […] The sick men claim to have been poisoned by mustard gas.[7]

The War Ministry, on October 4, 1918, pointed out "remarkable cases of self-disfigurement and the simulation of illness," among them the conjunctivitis also typical of mustard gas poisoning, created by rubbing soap in the eyes. Probably this was the reason for the directive of August 1918, later rescinded, "that no instruction about Yellow Cross is to be given for reasons of secrecy to the replacement recruits, only at the field recruit depot." The secrecy, in any case, can hardly have been directed towards the enemy, who at this point already possessed properly structured medical care (Gradmann 2003).

Poison gases displayed specifics in the area of the symptoms caused by them that could indeed awaken the suspicion of a simulation. The pathology of mustard gas poisoning, in particular, was not understood fully by contemporaries, so that the

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[6]"1. Nachtrag" zur Dienstvorschrift "Zur Kenntnis und Therapie der Gasvergiftungen," May 1918, 57. In Gradmann (2003, 148).

[7]Bericht der Krankensammelstelle 257 vom 1.10.1918. Bayerisches Hauptstaatsarchiv, Stv. Gen. Kdo., I. AK, San A, 176. In Gradmann (2003, 152).

diagnosis was reduced to the evaluation of external symptoms, such as the skin injuries resembling burns, irritation of the eyes, and disturbances of digestion. These symptoms, however, could be reproduced using hard soap or acetic acid. Additionally, there was the problem that appearances of illness could often take a good 4–6 h to appear, with nothing appearing initially. The believable report of gas poisoning could thus—even without symptoms—attain the usual 24-hour hospital stay for observation. Because mustard gas showed a high degree of persistence, poisoning could occur without any obvious contact—for example through grenade bombardment—and could even remain unnoticed at first. When one considers the enormous fear caused by the idea of a supposed poisoning even without symptoms, distinguishing the real and actual from the simulated in such cases must be problematic, to say the least. The doctors assumed, rightly, that there were many simulators among the supposedly gas poisoned. Those who really had been poisoned "were hard to tell from the others," as Oskar Minkowski in his *Handbook of Medical Experience in the World War* pointed out. The "others" were "afraid of having inhaled poison gas, or wished only to take the opportunity to leave the battlefield" (Minkowski 1921, 370). The nerve doctor Gaupp identified a frequent source of war neuroses in imaginary or simulated gas poisoning. The enormous effect of fear, especially in the case of mustard gas, made many think that the victim must be suspected of simulation or at least was aggravating, exaggerating, his symptoms. This is clear from a whole series of measures introduced in 1918 in a situation characterized by a general threat to discipline and, at the same time, the growing efficacy of the enemy's gas warfare. The corresponding regulations or white paper (see above) emphasized the analogy to the problem of the supposed simulation in war neuroses, and advised care in the application of the designation "gas poisoning":

> Instead of the definite term 'gas poisoning' or 'nervous shock through burial', which embeds itself in such cases in the mind of the patient to become a permanent idea of his sufferings, it is better to say simply 'complaints supposedly after gas poisoning' or 'nervous complaints, allegedly burial' (ibid.).

In addition, the rule for alleged gas victims was to keep them as near to the front as possible for observation. "Keeping men on the battlefield […] is [absolutely] necessary,"[8] was the corresponding regulation. A directive from the Ministry of War of August 1918 is also remarkable, stating that "no instruction about Yellow Cross is to be given for reasons of secrecy to the replacement recruits."[9] Secrecy towards the military enemy, who had over a year's painful experience to draw on and had long since set up effective medical facilities, was pointless. As reports of the simulation of mustard gas poisoning were already present, the point of secrecy can only have been to keep knowledge of these symptoms from the troops as far as

[8]Letter (classified): Armee-Abteilung des Bayerischen Kriegsministeriums an Generalkommandos der Armeekorps und ausbildende Stellen vom 23.8.1918. In Gradmann (2003, 152).

[9]Letter dated 27.9.1918, KM, chem. Abt, Nr. 3206/9.18 A 10. Bhsta, Stv GenKdo I. AK SanA 135. In Gradmann (2003, 152).

possible. This interpretation is also supported by the attempts made by the chemical department of the Ministry of War to counter "wrong ideas of the effect of mustard gas on the human body" (ibid.), which were circulating at the front, in such a way that one is forced to categorize these attempts as lying between euphemism and disinformation.

3 Gas and Psyche

It does not require much imagination to have an idea of the effect of the gas weapons on the psyche of the soldiers. The hoped-for effect of terror did not take long on both sides of the main front to take hold; even when only "enemy" troops were affected, soldiers knew very soon that this could reflect their own fate. The simple soldier thus did not share in the enthusiasm of the experts, the military commanders, and the politicians from the beginning. Probably many soldiers were more horrified than delighted at the new escalation of mass murder at the front, although we have few confirmations of this in the field letters. Thus, the miner F. Tholl, in a letter written from hospital on May 10, 1916, reflected on the consequences of the new kind of warfare:

> Hopefully this war of mass murder will soon come to an end. It is said that the English had to carry away their dead by the wagon after a successful German gas attack, losing thousands in one to two hours. What artillery destroys in numbers of men, is supposed to be nothing in comparison. War technology, then, is on the best road to destroying whole armies without spilling a drop of blood, choking them or putting them to sleep. What a humane way to wage war (Ulrich and Ziemann 1994, 95).

It was even worse for soldiers who had survived a gas attack, but had come into contact with some poisonous substance unknown to them, who had then dutifully reported to the doctor, only to hear their superiors suspect them of simulation and threaten them with disciplinary consequences for cowardice, instead of experiencing care and observation. This is pretty much what happened to the infantryman Birzer from the Upper Palatinate (Bavaria), who wrote to his mother, Anna Birzer, on 20 August 1917 from the trenches:

> My dearest mother! […] Last night at 2 o'clock, while I was standing at my post, the English carried out a very strong gas attack, 3 m left of me 3 gas grenades exploded. By the time I had got my gas mask on and had alarmed those below me, I had swallowed a bit of the gas. So I reported to the doctor, because every time they said, if you think you have swallowed some, go see the doctor right away (ibid., 95–96).

But Birzer had not reckoned with his company commander, who not only would not let him see the doctor, but railed at him:

> He tore a strip of me like nobody ever has, calling me a coward and a slacker, that's what he called me (ibid.).

The infantryman had observed how eight of his comrades and their company commander had died in the attack, and that otherwise a great many of his surviving comrades were in hospital already. He knew, too, that other soldiers would fall ill with delayed symptoms ("Usually it first comes over you the next day, then you become really ill"). Birzer was in despair: "Dearest mother, I cannot stand it any more, if it were not for you I would take my own life" (ibid., 280). About his company commander Birzer wrote: "Somebody like that should be shot." Birzer's letter was read by the field censor. Upon checking the incident, the infantryman's statements appeared more probable than the accusation of simulation put forward by his company commander, Reserve Lieutenant Münch. Münch was then sentenced by his regimental commander to a day's house arrest. Birzer was allowed to go to hospital for observation. Not all soldiers shared in his good luck.

The German public took up critical positions to the gas war in a very restrained manner. There were such critics, of course, for example among the pacifistic left. But reports of the special brutality of chemical warfare spread but slowly, even among pacifist circles. Thus, the anarchist and author Erich Mühsam wrote in his diary on 27 April 1915 after reports of the German chlorine gas attack near Ypres:

> […] near Ypres a victory has succeeded […] with stink bombs. They were at first only used by the Allies, in Germany they were outraged, now the whole world is outraged over Germany. I cannot deny the view that smoking out the trenches with chlorine vapours is no worse than killing the occupants with bullets and grenades. That this war is hardly a chivalrous one, is well known (Mühsam 1915).[10]

In the Reichstag (German parliament) in February 1918 a first critical debate about poison gas took place, after rumors has spread that a large, impending offensive in the West was being planned by the High Command, including a massive poison gas attack. All this had been preceded by the February call (February 8, 1918) by the International Committee of the Red Cross in Geneva to ban poison gas on the battlefield. After having been awarded the only Nobel Peace Prize of the entire war, the ICRC had finally felt morally obligated to condemn the barbaric innovations which had been introduced to warfare by the natural sciences, and to urge all concerned to keep to the Hague Articles of Land Warfare:

> Today we wish to raise our voices against a barbarous innovation which science is in the course of perfecting, that is, making it more murderous and more refined in its cruelty. We are speaking of asphyxiant and poisonous gases, the use of which, it seems, is growing to a scale hitherto unsuspected. The Regulations adopted at The Hague respecting the laws and customs of war on land contain the following: "It is especially forbidden to employ poison or poisoned weapons, and to employ arms, projectiles, or material calculated to cause unnecessary suffering." Asphyxiant or poisonous gases are without any doubt one of the

[10]Translated from the German original: "[…] bei Ypern ein größerer Sieg gelungen—und zwar mit Stinkbomben. Die wurden zuerst nur von den Alliierten angewandt, da entrüstete man sich in Deutschland, jetzt entrüstet man sich in aller Welt über Deutschland. Ich kann mich der Ansicht nicht verschließen, daß das Ausräuchern der Schützengräben mit Chlordämpfen nicht ärger ist als das Töten derInsassen mit Patronen und Granaten. Daß sich dieser Krieg in keinen ritterlichen Formen abspielt, weiß man ja schon."

> poisons forbidden under the Convention. Medical personnel are all unanimous in testifying to the terrible suffering caused by these gases, which is more harrowing to see than that resulting from the worst of wounds (World War I: the ICRC's appeal against the use of poisonous gases[11]).

To this day, it is difficult to understand why the ICRC was unable to issue such an appeal earlier, especially since, besides the Vatican and various Red Cross organizations in other, neutral countries, the powers involved in the war, too, had reacted quickly and positively. The President of France Raymond Poincaré let the ICRC in Geneva know that the Entente would give up the use of poison gas if the Central Powers would do likewise. The official note from the Entente of May was in the same tones, even mentioning a possible total ban of gas weapons, but placing the blame for their use entirely on the Central Powers. The German reply took a long time and was disappointing. The German Foreign Office informed Geneva on September 12, 1918, diplomatically brief and in fact untruly, only that Germany had agreed to earlier conventions against the use of poison gas; the enemy alone was responsible for the development and use of poison gas. There was no negotiating possible on this basis. In the Reichstag, however, the initiative of the Red Cross in a debate on the necessity of a "great offensive" to attain a "peace of power" in the West was certainly promptly discussed at the end of February. The only voice against the plan for such an offensive with the massive use of poison gas was that of the Berlin lawyer Oskar Cohn (1869–1934), member of the Reichstag for the USPD. It might well be, said Cohn, that the enemy could not withstand such an offensive, but then, he said—looking at the political representatives of the inner truce in the Reichstag—one "would freeze in this house from the hate of all mankind".[12] Cohn received support only from the rows of the USPD. It was a scandal that the German public, for reasons of censorship, knew nothing of the initiative of the Red Cross, although the international newspapers were full of it; in this manner, one would simply run directly into "the most horrible thing to happen in this war […], into the gas offensive in the West."[13] Gustav Stresemann, of the National Liberals, repudiated Cohn's references to the Red Cross vehemently. "In all of this," one could only see the "malicious repression of everything that Germany does" (ibid.), the attempt to "discredit our own Fatherland in the world out there," so as not to see "any wounds" in the others:

> You speak of how mankind trembles before the means with which we intend to prosecute the offensive in the West. Do you not know, then, how many thousands and thousands of German soldiers have been killed by the poison gas attacks of the enemy? […] When you speak of us having to freeze in the hate of the world, which would turn against us after this war, well—you are encouraging that hate by attacking Germany![14]

[11]See https://www.icrc.org/eng/resources/documents/statement/57jnqh.htm.

[12]Stenogr. Berichte d. Reichstags, 131. Sess., 22.2.1918; Bd. 311, p. 4084A.

[13]Stenogr. Berichte d. Reichstags, 131. Sess., 22.2.1918; Bd. 311, p. 4085A.

[14]Stenogr. Berichte d. Reichstags, 131. Sess., 22.2.1918; Bd. 311, p. 4088B.

At least Philipp Scheidemann (1865–1939) at the end of February 1918 for the SPD, like Cohn, again critically pointed to the press censorship, which simply prevented the public from being informed about such "great-hearted suggestions" such as that of the Red Cross—never mind allowing said public a voice. Probably the Reich Government had already sent a response to Geneva which did not reflect the general opinion in the matter, commented Hugo Haase (1863–1919) for the USPD:

> What would it have cost the German Government to respond to this suggestion by saying: Yes, we are prepared to do so, if the others also pledge themselves to so do? But no! They could not wait to see whether the others wanted this too, but right from the start they reserved this means, any means for themselves. We are not surprised; we have heard, often enough, that all means were justified in this war, if they only lead to victory, no matter how cruel such means are.[15]

The MP was wrong in this case: Berlin had not yet responded and was clearly not prepared to before the planned offensive in the West.

4 Weimar to the Nazi Period—the Need of the Traumatized

During the Weimar Republic, war trauma was basically recognized as damage incurred during military service. De facto, however, there were pension cuts and the withdrawal of state benefits in so-called "doubtful cases" already in the 1920s and early 1930s. The evidence is the exemplary pension statistics of the official pension offices in each town. Nils Löffelbein has examined this for Munich and shows that in the city of Munich and the surrounding country area alone (München-Land), some 66.4% of the benefits applications based on psychological trauma were refused from the start (Löffelbein 2013). Among these, without any doubt, were numerous soldiers whose alleged gas injuries or psychotrauma were not interpreted as real damage caused by the war, but attributed to a greedy and fraudulent attempt to obtain a pension on the basis of simulation, simulation which was insinuated and presumed. There were, in addition, general problems in providing benefits and pensions in the First German Republic.

If the Weimar democracy found itself in an emergency condition after the Reichstag elections of 1930, the year 1932 made the social catastrophe even worse. The Great Depression was worse than could have been imagined; mass unemployment and the fall into poverty took on unimaginable dimensions. The cuts in the state benefits for veterans reached a new high in the summer of 1932 with the third emergency directive released by the Papen government. Hindenburg's objections, too, who wrote to the Reich Chancellor expressing the deepest misgivings about the cuts in the veterans' pensions, or at least advocated some relief

[15]Stenogr. Berichte d. Reichstags, 135. Sess., 27.2.1918; Bd. 311, p. 4213B.

from the hardships, remained without effect. The directive came, and it gave new impetus to the feelings of revolt among the wounded veterans and their relatives.

The Nazi propaganda after 1933 was correspondingly careful to distinguish between war-wounded, disabled veterans, to whom the nation was forever grateful, and who were potentially able to place their remaining strength at the disposal of the national community, and useless "ballast existences", unable to work. The wounded of the First World War were at the top of the Nazi scale of social value, celebrated as "honorary citizens of the nation" before all other groups of the handicapped. But only physically wounded soldiers were regarded as worthy of benefits, who, in the words of Reich Health Leader Leonardo Conti, were to be classified as "highly valuable people accused of war" (Löffelbein 2013, 329). Mentally ill veterans, on the other hand, were vilified as "simulants," "hunters after pensions", "unclean elements" (*Volksschädlinge*), who damaged the reputations of the true victims of the war in public (ibid., 238–239). Soon after the National Socialist "takeover" (*Machtergreifung*), mentally ill veterans (ca. 16,000 between 1934 and 1938) were deprived of all pensions (Neuner 2011, 198). Not only that a great number of them were sterilized, some of them became also victims of the so-called "euthanasia" and were killed between 1939 and 1945 (ibid., 315–324). We don't know how many of those mentally ill (most of them patients with "war neurosis") had been traumatized by gas attacks. However, it must have been a considerable number because gas attacks rated high among the causes of "war neurosis."

In order to answer the rather obvious question as to why, then, since the war there had been several thousand mentally ill front-line soldiers, an ideological maneuver was thought up, the construction of a direct connection between traumatization and the Weimar "system period" of 1918 until 1933. The war, according to this, was not the cause of the mental suffering of the veterans. Rather it was the Weimar welfare system, which had supposedly produced large numbers of pension neuroses, anti-social and psychopathic elements. "Anti-social" behavior was supposedly directly furthered by the climate of the Weimar welfare state.

5 Summary

The most depressing aspect, probably, of the technical and industrial modernity of the Great War was chemical warfare, which particularly reveals the interlinkage of medical and military technology. Seen from the military aspect, the use of poison gas was not very effective and by no means decisive for ending the war. Seen, on the other hand, from the psychological and humanitarian point of view, it was a disaster for the soldiers' minds and bodies wherever it was put to use. The fear of "gas" was paralyzing, and the wounds caused by most of the poisonous substances were terrible. Chemical warfare must be looked upon as the first failure of science and technology in the twentieth century. Scientists completely submitted themselves to the murderous necessities of war and not only provided their knowledge

but participated totally in the perfidious creativity of mass murder on the battlefields. The paper outlines this subjugation of science to the military and then changes its perspective to the soldiers' perception of chemical war on the battlefield and after the war, which was shaped by dread and long-lasting traumatization. The paper's last part describes the political and psychic stigmatization of the mentally traumatized in Germany. Many of them had been physically wounded and mentally shocked by poison gas. Whereas to the war-wounded and disabled veterans the nation was forever grateful, the mentally ill were stigmatized, sterilized, and some of them even murdered. Thus, WWI chemical warfare continued its terrible destruction long after the armistice on the battlefields.

References

Baumann, Timo. 2011. *Giftgas und Salpeter. Chemische Industrie, Naturwissenschaft und Militär*. Dissertation, Universität Düsseldorf.

Brauch, Hans Günter. 1982. *Der chemische Alptraum oder gibt es einen C-Waffen-Krieg in Europa?*. Berlin: Dietz.

Eckart, Wolfgang U. 2014. *Medizin und Krieg: Deutschland 1914–1924*. Paderborn: Schöningh.

Gaskrieg während des Ersten Weltkrieges. Wikipedia. https://de.wikipedia.org/wiki/Gaskrieg_während_des_Ersten_Weltkrieges. Accessed 10 Jan 2016.

Gaupp, Robert. 1922. Schreckneurosen und Neurasthenie. In *Handbuch der Ärztlichen Erfahrungen im Weltkriege*: *Geistes- und Nervenkrankheiten*, vol. 4, ed. Karl Bonhoeffer, 68–101. Leipzig: Barth.

Gradmann, Christoph. 2003. "Vornehmlich beängstigend." Medizin, Gesundheit und chemische Kriegführung im deutschen Heer 1914–1918. In *Die Medizin und der Erste Weltkrieg*, eds. Wolfgang U. Eckart and Christoph Gradmann, 131–154, 2nd ed. Herbolzheim: Centaurus.

Haber, Ludwig F. 1986. *The poisonous cloud. Chemical warfare in the First World War*. Oxford: Clarendon.

Hanslian, Rudolf. 1934. *Der deutsche Gasangriff bei Ypern am 22. April 1915. Eine kriegsge-schichtliche Studie.* Berlin: Gasschutz und Luftschutz.

Kästner, Ingrid and Susanne Hahn. 1994. Der Toxikologe Otto Muntsch (1890–1945) und die deutsche Kampfstoffforschung. *1999. Zeitschrift für Sozialgeschichte des 20. und 21. Jahrhunderts* 4: 42–50.

Löffelbein, Nils. 2013. *Ehrenbürger der Nation. Die Kriegsbeschädigten des Ersten Weltkriegs in Politik und Propaganda des Nationalsozialismus.* Essen: Klartext.

Minkowski, Oskar. 1921. Die Erkrankung durch Einwirkung giftiger Gase. In *Handbuch der Ärztlichen Erfahrungen im Weltkriege 1914/18*: *Innere Medizin*, vol. 3, ed. Ludolf von Krehl, 340–383. Leipzig: Barth.

Mühsam, Erich. Tagebücher. Heft 13. http://www.muehsam-tagebuch.de/tb/diaries.php#d_1915_04_27. Accessed 1 Dec 2014.

Müller, Rolf-Dieter. 2003. Gaskrieg. In *Enzyklopädie Erster Weltkrieg*, ed. Gerhard Hirschfeld, Gerd Krumeich, and Irina Renz, 519–522. Paderborn: Schöningh.

Muntsch, Otto. 1935. *Leitfaden der Pathologie und Therapie der Kampfgaserkrankungen*. Leipzig: Thieme.

Neuner, Stephanie. 2011. *Politik und Psychiatrie. Die staatliche Versorgung psychisch Kriegsbeschädigter in Deutschland 1920–1939.* Göttingen: Vandenhoeck & Ruprecht.

Roth, Karl-Heinz. 2009. Die Geschichte der I.G. Farbenindustrie AG von der Gründung bis zum Ende der Weimarer Republik. http://www.wollheim-memorial.de/de/ig_farben. Accessed 12 July 2013.

Szöllösi-Janze, Margit. 1998. *Fritz Haber 1868–1934. Eine Biographie*. München: Beck.
Ulrich, Bernd, and Benjamin Ziemann (eds.). 1994. *Frontalltag im Ersten Weltkrieg: Wahn und Wirklichkeit. Quellen und Dokumente*. Frankfurt am Main: Fischer.
World War I: the ICRC's appeal against the use of poisonous gases. Full text of the appeal to the belligerents, issued by the International Committee on 8 February 1918. http://www.icrc.org/eng/resources/documents/statement/57jnqh.htm. Accessed 13 July 2013.
Zeidler, Manfred. 1993. *Reichswehr und Rote Armee. Wege und Stationen einer ungewöhnlichen Zusammenarbeit*. München: Oldenbourg.

Chemical Weapons Research on Soldiers and Concentration Camp Inmates in Nazi Germany

Florian Schmaltz

Abstract In 1944 and 1945 scientists and physicians in the Allied military intelligence gathered evidence on the criminal human experiments with chemical weapons conducted on inmates of the Nazi concentration camps in Sachsenhausen, Natzweiler, and Neuengamme during World War II. Some of the experiments were judged during the Nuremberg Medical Trial (Case I) and French military tribunals at Metz and Lyon after liberation. Based on this evidence and on further archival sources, this paper will examine the preconditions and settings of these experiments, the perpetrators involved, and what is known about their purpose and outcome. Furthermore, the paper will raise the question if and how the experiments in the concentration camps were linked to other experiments conducted in Nazi Germany for the Wehrmacht at military research establishments such as the Gas Protection Laboratory (Heeresgasschutzlaboratorium) in Spandau, the Militärärztliche Akademie, the Heeresversuchsstelle Raubkammer, or by universities. The paper will focus on experiments with chemical agents in German concentration camps and analyze how rivalry and division of labor between the military and the SS in human experimentation with chemical agents went hand in hand.

1 Organizational Structures of Chemical Warfare Research in Germany

Chemical warfare research in military and academic contexts is generally an issue of secrecy. It encompasses screening, identification of potential chemical agents suitable for use as weapons, means and methods for their large-scale industrial production, storage and deployment, as well as defensive research in toxicology on animals and humans. It also includes possible medical prophylaxis and treatments, as well as measures and technologies for detecting chemical agents and protecting soldiers and civilians against the severe injuries and health risks involved. In contrast to other fields of scientific research, most of the results on chemical warfare

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B. Friedrich et al. (eds.), *One Hundred Years of Chemical Warfare: Research, Deployment, Consequences*, DOI 10.1007/978-3-319-51664-6_13

issues have remained unpublished. In the case of Nazi Germany, military agencies and private companies involved in the research, development, and production of chemical weapons systematically destroyed their records from Fall 1944. Since the intention was to avoid written evidence, orders were given only orally so that events remained undocumented. This holds even truer for the human experiments conducted in concentration camps. The determination to cover up and destroy evidence of war crimes and crimes against humanity by the perpetrators in Nazi Germany makes it difficult to establish the historical facts. Uncertainties will remain.

The utilization of hydrogen cyanide (known under the trademark Zyklon B) or carbon monoxide as gasses used in the destruction of the European Jews, Sinti, and Roma in the extermination camps at Auschwitz, Majdanek, Sobibor, Treblinka, and other places, or the murder of invalids and handicapped persons at these killing centers will not be discussed in this paper. Both compounds were not suitable for extra mural deployment as war gas because of their fugacity.[1]

In the Weimar Republic, research and development of chemical weapons had been organized in a covert network of smaller dislocated working groups and laboratories in Germany and abroad by means of a secret collaboration between the Reichswehr and the Red Army (Müller 1985; Brauch and Müller 1985; Groehler 1992; Krause and Mallroy 1993; Schmaltz 2005).

After the Nazis had seized power in January 1933, the research and development of chemical weapons became high priority in the context of the armament policy of the new regime. Efforts were made to establish a greater research infrastructure with more than 1000 employees working in three army-operated chemical warfare research centers. The largest institution by far became the testing ground and laboratories of the Wehrmacht at Raubkammer near Munster with an average of 500 employees, peaking at 800 in 1944 (Mills 1945, 9). The second in size was the so-called Gas Protection Laboratory (Heeresgasschutzlaboratorium) installed by the Army Ordnance Office (Heereswaffenamt, Wa Prüf 9) in the Citadel Spandau, which insulated and shielded its 450 employees from the public. Despite its name, the Gas Protection Laboratory also conducted offensive research on new chemical agents. In addition, the Gas Protection Office of the Army Ordnance Office (Wa Prüf 9) was established in Berlin with an average of 143 employees, peaking at 200 in 1944 (Mills 1945, 9) (Table 1).

The Military Medical Academy (Militärärztliche Akademie) in Berlin reopened in October 1934 in the building of the Kaiser Wilhelm Academy which had been closed consistent with the Treaty of Versailles (Neumann 2005, 70). There, the Department of Pharmacology and Military Toxicology (Institut für Pharmakologie und Wehrtoxikologie), headed by Otto Muntsch and Wolfgang Wirth, played an

[1]For the history of Zyklon B and the gas chambers in German concentration camps, see Szöllösi-Janze (1994), Ebbinghaus (1998), Kalthoff and Werner (1999), Joly (2000), Hayes (2004, 272–300), Morsch and Perz (2011), Trunk (2011).

Table 1 Organization of German chemical warfare research and development[a]

Heeresversuchsstelle (Army experimental station), Raubkammer (Munster)	Heereswaffenamt (Army ordnance office)—Wa Prüf 9, Berlin (Group 1–12)	Heeresgasschutzlaboratorium (Army gas protection laboratory), Spandau[b]	
		Dept.	Research field
R I: Field trials	1: Organization and direction	F1	Chemical synthesis
R II: Chemical analysis	2: Gas defense	F2	Analytical chemical
R III: Decontamination and detection	3: Decontamination and gas protection		Lab. 1 Polarimetry
R IV: Vehicles and workshops	4: Mechanical		Lab. 2 Sarin and tabun
5: Extra mural research	5: Extra mural research		Lab. 3 Examination of loot, HCN determination, ampoules and storage
6: Gas and smoke weapons	6: Gas and smoke weapons		Lab. 4 Mustard (derivates)
7: Testing field trials	7: Testing field trials		Lab. 5 Chamber trials
8: CW Manufacture (technology)	8: CW Manufacture (technology)		Lab. 6 Sarin research
9: Finance	9: Finance	F 3	Microchemistry
10: Incendiaries	10: Incendiaries		Microchemical and physicochemical
11: Patents	11: Patents		Physical measurements
12: Veterinary	12: Veterinary		Smoke
13: Intelligence	13: Intelligence		Adsorption and desorption of charcoal
			Molecular weight measurements
		F 4	Measurements of concentrations on films
		F 5	Library
		IIL	Individual
		IIIL	Collective protection
		IIIaL	Filter units
		IIIbL	Detection and recognition
		IIIcL	Decontamination/CW munitions
		IVL	Mechanical
		VWL	Physiological chemical
		VIaL	Ground contamination
			Lab. 1: Dust
			Lab. 2: Organic chemicals
			Lab. 3: Organic chemicals
			Lab. 4: Mustard
		VIbL	Smoke and thermal generators

(continued)

Table 1 (continued)

Heeresversuchsstelle (Army experimental station), Raubkammer (Munster)	Heereswaffenamt (Army ordnance office)—Wa Prüf 9, Berlin (Group 1–12)	Heeresgasschutzlaboratorium (Army gas protection laboratory), Spandau[b]	
		Dept.	Research field
		VIcL	Small scale development of shells—HE tests for shells
		VIdL	Meteorology
		VIIL	Toxicological Institute (animal- and human experiments)
		VIIIL	Semi-technical scale plant chemical storage

[a]A. K. Mills, Investigations of Chemical Warfare Installations in the Munsterlager area, including Raubkammer. *CIOS File No.* XXXI-86, (London SHAEF Combined Intelligence Objectives Sub-Committee—G-2 Division: 1945), Tables I-III on pp. 27–33
[b]Ibid., Table II, pp. 29–31

important role in chemical warfare research.[2] The Military Medical Academy and the Army Ordnance Office (Wa Prüf 9) established a network of outposts at universities in Marburg, Munster, Giessen, Würzburg, Greifswald, and at the Academy of Medicine at Danzig (Oehler-Klein and Neumann 2004; Schmaltz 2006b; Eberle 2015, 505–524). Furthermore, several institutes of the Kaiser Wilhelm Society were also included in this network after 1933 (Schmaltz 2005, 2009).

While the hegemony of military institutions in chemical warfare research remained dominant until the end of World War II, from 1942 on the SS tried to assert itself against the Wehrmacht through its research organization, the SS-Ahnenerbe. Initially founded as a registered association in 1935, the SS-Ahnenerbe was incorporated between the end of March and April 1942 into the Personal Staff of the Reich leader of the SS, Heinrich Himmler (Kater 1997, 11, 302, 463; Schleiermacher 1988, 79–83; Reitzenstein 2014, 34). In July 1942, the SS-Ahnenerbe established the Institute for Applied Military Research (Institut für wehrwissenschaftliche Zweckforschung), with a special branch headed by the anatomist August Hirt at the "Reichsuniversität Straßburg" to foster chemical warfare research (Schmaltz 2005, 530). With its direct link to Himmler, the SS-Ahnenerbe had privileged access to concentration camp inmates as subjects for human experimentation. From May 1944 all SS and police agencies had to apply to Himmler for personal authorization to conduct human experiments in concentration camps. Applications had to be submitted to the Reichsarzt-SS, substantiating scientific objectives as well as the required number of prisoners and duration of experiments.[3] There is no doubt that military experts were informed about specific human experiments with chemical

[2]For Muntsch's career, see Kästner and Hahn (1994), Neumann (2005, 83).
[3]Himmler (Reichsführer SS), copy, May 15, 1944, Bundesarchiv Berlin (BArch), R 26 III/729, fol. 36; Schmaltz (2005, 176–177), Hahn (2008, 480).

agents in concentration camps. Some of the military experts were also involved in their preparation and evaluation.

In addition to military laboratories and academic research institutions, chemical warfare research was also undertaken in the laboratories of private chemical companies. However, chemical warfare research in private companies such as I.G. Farbenindustrie on nerve agents apparently only involved animals and self-experiments on humans. Regarding the military, there are no documents available that give evidence of forced human experiments in industrial research laboratories (Schmaltz 2005, 455–459).

2 Chemical Weapons Research on Humans in Military and Academic Institutions

New compounds suitable for chemical warfare were regularly first tested on animals and humans at the Military Medical Academy in several gas chambers with a volume of 2–3 cubic meters before toxicological studies were conducted in the 10, 30, and 100 m^3 gas chambers of department VII L, or the larger gas chambers of the Gas Protection Laboratory at Spandau with 250 and up to 1000 m^3 (Mills 1945, 9–10). The human experiments were conducted in self-experiments by the scientists and on soldiers, officer cadets, members of student companies (*Studentenkompanien*), and convalescent companies (*Genesungskompanien*). These experiments covered toxicological evaluations, defensive protection technologies (gas masks and protection gear), and the treatment of injuries caused by chemical agents (Schultz 2001; Kopke and Schultz 2001, 242–246; Baader 2002; Neumann 2005, 288–298; Woelk 2003, 283). The participants from the military knew that the experiments implied health risks. Officially, military test persons participated voluntarily, but we can assume that peer pressure as well as compensation offered of between 5 and 100 Reichsmarks may have been an incentive (Kopke and Schultz 2001, 243–244; Neumann 2005, 289–290). Apart from the pain experienced during the actual experiments, the long-term health problems and consequential suffering are well documented for a number of cases (Spiegelberg et al. 1961). The publicist Ernst Klee claimed that on several occasions, death row inmates at Plötzensee Prison were transferred to the Gas Protection Laboratory and subjected without their consent to experiments with chemical agents (Klee 1997, 272–273).[4] This statement is based on only one testimony of a hearsay witness, who did not accompany the prisoners to the alleged experimentation.[5]

[4]Affidavit of the former juridical officer Affidavit Walter Strelow, November 27, 1946, NG-405, in Dörner et al. (2000b, microfiche 4/7764-7766).

[5]For a critical review of Klee's (mis)interpretation, see Kopke and Schultz (2001, 245–246), Neumann (2005, 295–296).

Nonetheless, the experiments in the military institutions remained ethically and legally dubious. The "Regulations Concerning New Therapy and Human Experimentation," issued by the Reich Ministry of Interior in 1931 prohibited experimentation "in all cases where consent has not been given."[6] To date, no sources on any internal discussions concerning ethical frameworks or the implementation of regulations for human experiments in military institutions during the Nazi era have been found. As the historian Ulf Schmidt has emphasized, military researchers either ignored the 1931 guidelines or were unaware of their existence (Schmidt 2013, 236; Roelcke 2017). In many cases, it is unclear if sufficient animal testing had taken place prior to the human experiments with chemical agents. In contrast to this complete lack of any institutionalized regulation of ethical issues concerning human experiments, the Nazi regime established such regulations for animal experiments in line with the animal protection law of 1933. In spring 1939, the medical service of the Wehrmacht (*Sanitätsinspektion*) restricted animal experiments to scientific laboratories, and a number of military institutes established frequent expert inspections.[7] The German attack against Poland further weakened the limitations set by medical ethics. German soldiers suffering from battle wounds and infections and civilians affected psychologically by Allied air raids, along with chemical warfare experts and physicians all radicalized their approach to exploiting vulnerable concentration camp inmates as subjects of human experiments. During World War II, human experiments dealing with agents suitable for chemical warfare were conducted in the concentration camps at Sachsenhausen in 1939, at Natzweiler from 1942 to 1944, and at Neuengamme in 1944.

Rumors about another series of human experiments with war gasses on inmates of a sub-camp of the concentration camp Groß-Rosen, who were forced to work in the nerve gas factory at Dyhernfurth near Breslau where tabun was produced and filled in shells from 1942 onward, are not confirmed by available sources. There is no doubt, however, that camp inmates were forced to work at Dyhernfurth in the extremely dangerous tabun production and filling stations with only insufficient protection, and consequently suffered severe damage to their health (Czernik 1974; Groehler 1989, 245–248; Ebbinghaus 1999, 185–186). Accidents—some of them fatal—occurred frequently, even among the German workers (Jones 1945, 10). While eyewitness accounts confirm that emergency treatments with atropine were used, no evidence has been established so far that camp inmates were subjected to standardized human experiments in a controlled manner.[8]

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[6]Rundschreiben des Reichsministers des Inneren vom 28.2.1931: Richtlinien für die neuartige Heilbehandlung und für die Vornahme wissenschaftlicher Versuche am Menschen 1931, see Schmidt (2013, 236), Sass (1983), Grodin (1992, 129–132).

[7]Waldmann (OKW B 49 OKH/AHA S In II) to Militärärztliche Akademie (copy), April 29, 1939; Müller (OKW B 49 OKH/AHA S.In II) to Militärärztliche Akademie (addendum), May 31, 1939, Bundesarchiv-Militärarchiv (BA-MA) Freiburg, RH 12-23/1740.

[8]The former prisoner Tadeusz Karol, who survived the Dyhernfurth concentration camp, testified that he was ordered to enter the filling station without gas protection gear in order to examine a possible contamination with tabun. Karol collapsed after being injured by the nerve agent. An

3 Experiments in Concentration Camps

3.1 Sachsenhausen

On September 8, 1939, one week after the invasion of the Wehrmacht in Poland, Polish troops who were withdrawing accidently used sulphur mustard mines instead of regular explosives to blow up a bridge at Jaslo. This incidence caused mustard gas injuries to 14 German soldiers, two of which were fatal. The incident immediately led to an investigation by German chemical warfare experts.[9] In direct response to this incident, the Military Medical Academy and the SS initiated several series of tests to evaluate possible treatments of skin wounds caused by sulphur mustard gas. At least two series were conducted in the concentration camp at Sachsenhausen on a total of 31 prisoners. The wounds were treated with different drugs: (1) Freskan (code name F 1000 and F 1001), a powder produced by the company Dr. Fresenius (Bad Homburg) to cure skin burns; (2) the Holzmannsche-Lost-Heilmittel; and (3) probably Thiosept, an ointment based on sulphurous shale oil (Figs. 1 and 2, Table 2).

For the first series of experiments, Reichsarzt SS Dr. Ernst Grawitz ordered SS physician Dr. Hugo-Heinz Schmick, then in charge of the surgical ward at Sachsenhausen concentration camp, to conduct the experiments.[10] Schmick worked together with camp physician Dr. Walter Sonntag. On October 13, 1939 sulphur mustard was applied to the upper arms of 23 inmates.[11] According to an account by the former political prisoner Hans Kargl,[12] he and four other inmates from his barrack (Theuer, Steinmeyer, Hahn, and Grunert) were treated with a "yellow liquid" which was smeared in a radius of about 3 cm on both upper arms causing blistering,

(Footnote 8 continued)

atropine injection saved his life. See OK Wroclaw, Ds 1/68, pp. 225–227 and 244–247, eyewitness testimony by Tadeusz Karol, cited after Witkowski and Rudy (1987, 135–136). I am grateful to Esther Chen (Max Planck Institute for the History of Science) for her helpful advice and explanation concerning the Polish publication.

[9]Wolfgang Wirth (Heereswaffenamt Gasschutzabteilung): Bericht über die Verwendung von Lostminen durch die Polen bei Jaslo am 8.9.1939, September 16, 1939, BA-MA Freiburg, Bestandsergänzungsfilm WF-01/20871 (National Archives Washington, DC, Microfilm, T-77, reel 876, frames 5624376-5624396); Martinetz (1996, 167–168), Gellermann (1986, 135–136).

[10]Hugo Heinz Schmick (1909–1982) became a member of the NSDAP in August 1933 (No. 3681138) and of the SS (No. 84693) in May 1933. From June 1939 he was assigned to the concentration camp Sachsenhausen where he was ordered to establish the surgical ward. SSO Akte Hugo-Heinz Schmick, geb. 30.3.1909, BArch, VBS 286/6400039545; NSDAP-Ortsgruppenkartei Hugo-Heinz Schmick, geb. 30.3.1909, BArch, VBS 250. Vernehmungsprotokoll von Dr. Hugo Schmick durch den Untersuchungsrichter beim Landgericht Duisburg, July 21, 1951, Archives of the Memorial and Museum Sachsenhausen (AMMS), JD 1/22, pp. 19–22; Kopke and Schultz (2001, 247).

[11]Dr. Sonntag, Abschlußbericht über die mit L. am 13. Oktober 1939 geimpften 23 Fälle, December 22, 1939 (=NO-198), BArch, NS 19/1582, fol. 2.

[12]For the biography of Hans Kargl (1884–1960) see Ley and Morsch (2007, 335–337).

Fig. 1 Walter Sonntag (Courtesy of the Bundearchiv R 9361-III/195957)

open wounds.[13] These were then treated with an ointment (probably Thiosept) and Freskan. According to Kragl, the treatment caused violent pain.[14] Assisted by the orderly Fritz Langheinrich, the wounds and the healing process were documented in medical records, on film, and photographs.[15] In the second series of experiments, eight prisoners were treated with mustard gas on both arms. After three days, the blisters were opened to infect the wounds of two prisoners with a mixed flora of streptococcus, staphylococcus, and pneumococcus bacteria. Another two of the eight

[13]Hans Kargl: Erlebnisniederschrift über die Zeit der Verfolgung und Inhaftierung während des Naziregimes. (Typoskript), undated, AMMS, P3 (Stadtarchiv Hanau, 103/85), fol. 55–56; Kopke and Schultz (2001, 116–117).

[14]Ibid. For the name of the ointment, see Landgerichtsrat Peterek (Untersuchungsgericht Duisburg): Vernehmung von Mathias Mai, December 6, 1950, AMMS, JD 1/22, fol. 6–8.

[15]Wissner (Kriminalpolizei Düsseldorf): Vernehmung von Fritz Langheinrich, November 18, 1949, Archives of the Memorial and Museum Sachsenhausen JD 1/22, fol. 2–5.

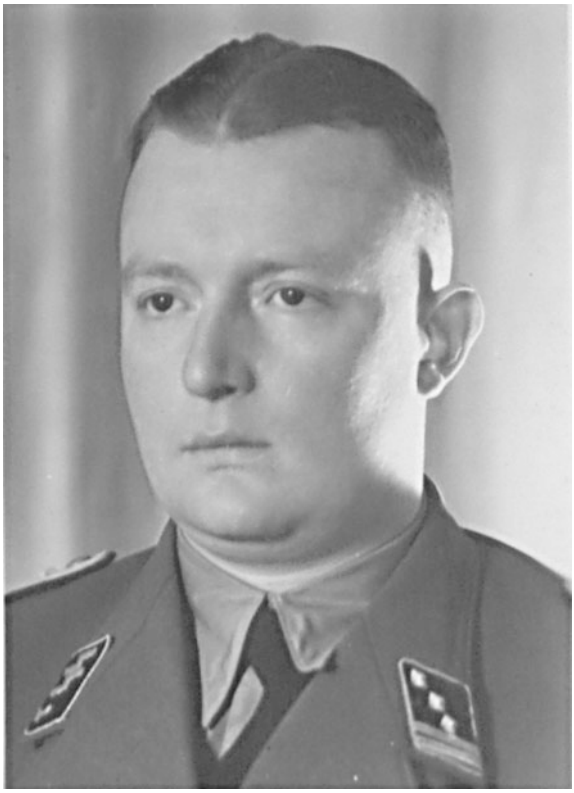

Fig. 2 Hugo Heinz Schmick (Courtesy of the Bundesarchiv NSDAP Zentralkartei)

Table 2 Concentration camp Sachsenhausen: mustard gas experiments

Time period	Researcher	Objective	Subject
13 Oct.–Dec. 1939	Walter Sonntag Hugo Heinz Schmick	Therapeutic effect of Freskan powder	23 concentration camp inmates[a]
	Fritz Langheinrich	Holzman remedy	
Dec. 1939	Walter Sonntag Hugo Heinz Schmick	Ditto and antiseptic effect on bacterial infections	8 inmates

[a]The numbers of victims vary. While Sonntag noted in his report that 23 inmates were used, former prisoner Frank Cyranek estimated a number of 28 to 30 prisoners. See Vernehmung von Franz Cyranek, copy, (undated), Archives of the Memorial and Museum Sachsenhausen (hereafter cited as AMMS), JD 1/22, fol. 16

prisoners received the same treatment on the fourth day.[16] Some of the wounds reached a size of 7 × 18 cm. The infected prisoners developed sepsis with high temperatures, shivering, swelling of the glands, and enlarged spleens.[17] The prisoners' suffering led to the insight that neither Holzmann's remedy nor the Freskan powder had any healing effect on the mustard gas wounds or the infections.[18] In January 1940 Reichsführer SS Heinrich Himmler was informed about the negative results.[19] While the experiments of the SS were taking place at the Sachsenhausen concentration camp, the Wehrmacht had also started a series of human experiments investigating the efficacy of Freskan powder F 1000 and F 1001 for the decontamination and therapy of skin lesions caused by mustard gas.[20] The two chemical war experts who conducted those experiments were Ludwig Lendle and Wolfgang Wirth. Lendle was one of the leading German pharmacologists at the time and since 1936 director of the Institute for Pharmacology at the University Münster. In August 1939 Lendle was ordered on duty to the Institute for Pharmacology and Military Toxicology at the Military Medical Academy.[21] There he collaborated with the head of this institute, Wolfgang Wirth.[22]

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[16]SS-Untersturmführer Dr. Sonntag, Vorläufiger Bericht über 8 Fälle von 'Öl-O'-Verätzungen und deren Behandlung mit dem Mittel 'H' bzw. 'F 1001' unter Setzung einer Infektion in 4 der Fälle, December 22, 1939, BArch, NS 19/1582, fol. 4.

[17]Ibid., fol. 5–6.

[18]Ibid., fol. 6.

[19]Grawitz to Personal Staff RFSS, January 5, 1940, BArch, NS 19/1582, fol. 3. Himmler received the letter on January 16, 1940.

[20]Bericht über die Eignung der Freskanpuder F 1000 und F 1001 zur Entgiftung und Behandlung von Lostschäden der Haut, December 21, 1939, secret, signed Lendle and Wirth, pp. 1–49 and 1 Table, BA-MA Freiburg, RH 12–23/1728.

[21]For Lendle's biography and his activities concerning chemical warfare research, see Schmaltz (2005, 468–470); Lendle, Lebenslauf, January 29, 1945, BArch, R 9361 II, Parteikorrespondenz, Ludwig Lendle, born February 2, 1899; for his postwar career, see Schmidt (1985).

[22]Wolfgang Wirth (1898–1996), studied studied chemistry in Munich and Würzburg and medicine in Berlin. He worked as assistant to Gauss at the University Clinic and as assistant to Werner Haase at the Laboratory for physiological Zoology of the Biologische Reichsanstalt für Land- und Forstwirtschaft. Wirth conducted research on chemical agents during the Weimar Republic in Germany and in the context of the secret collaboration with the USSR on behalf of the Army Ordnance Office. Wirth became a member of the SA in 1933 and the NS-Lehrerbund, the NSV, and the Reichskolonialbund in 1936. From April 1936 until January1938 he worked for the Heereswaffenamt Wa Prüf 9 (Army Ordnance Office, Chemical Warfare Department) and changed in February 1938 to the Militärärztliche Akademie (Military Medical Academy), where he headed the Pharmacological Institute. From June 1941 Wirth was the provisional commander and from August 1942 to August 1943 the commander of the Lehrgruppe C—Forschungsgruppe (Teaching Group C/Research Group) at the Military Medical Academy. Wirth was arrested in June 1945 and interned in Nuremberg during the Doctors Trial between December 1946 and August 1947. In 1948 he entered the Pharmacological Department of the Farbenfabriken Bayer A.G. in Wuppertal which he headed from 1954 until his retirement in 1963. See Military Government of Germany. Fragebogen Wolfgang Wirth, June, 14, 1946, pp. 19–28; Lebenslauf Wolfgang Wirth, 30.8.1944, and Lebenslauf 1.6.1944, US Army—Freedom of Information/Privacy Office—Fort G. Meade, Investigative Records Repository, file Wolfang Wirth. For Wirth's biography, see Kopke and

Lendle and Wirth conducted a series of human experiments on 23 officer cadets (*Fähnriche*) at the Military Medical Academy. They began by smearing one gram of LOST on two parts of the underarm of the soldiers. No decontamination measures followed. The dose applied was strong enough to cause deep skin lesions leading to necrosis, which only healed after 6–8 weeks.[23] They came to the conclusion that the capacity of Freskan powder F 1001 to detoxify was insufficient and that Losantin led to better results.[24] Although the healing process with these powders had been rather ineffectual, both Lendle and Wirth recommended the extension of the experiments with Freskan powder to "patients with more expanded and less penetrative LOST injuries as preferable."[25]

It has been debated in historiography whether Lendle and Wirth conducted their experiments in direct cooperation with the SS physicians who had been in charge of the mustard gas experiments in Sachsenhausen. Christoph Kopke and Gebhard Schultz interpreted the relations of the army chemical warfare experts with the SS physicians as cooperation. Refuting this claim, historian Alexander Neumann emphasized that there was no hint or even a covert allusion to the Sachsenhausen experiments in the report by Lendle and Wirth (Neumann 2005, 291). However, this is not the case since Lendle and Wirth reported in two experiments about "a round blister frequently emerging around an anemic corona." They tried to "expose the base of the lesion by brushing it with a sterile steel brush, as had been done with the cases treated at Sachsenhausen."[26] The explicit reference to "cases treated at Sachsenhausen" clearly indicates that Lendle and Wirth had knowledge about the medical treatment of the wounds of concentration camp inmates who were subjected to the mustard gas experiments at the time they conducted their own experiments on cadets from the Military Medical Academy. This contemporary source gives clear evidence that Lendle and Wirth, as army physicians, had established relations with the SS, which included an exchange of expert knowledge and experience from human experimentation with chemical agents and the therapeutic treatment of mustard gas injuries. After the defeat of Germany, when being interrogated in 1947 in a statutory declaration, Wirth denied any knowledge of experiments undertaken in German concentration camps.[27] It was not before 1951, when the public

(Footnote 22 continued)

Schultz (2001, 247–249), Klee (2001, 298–303), Woelk (2003, 271–276), Neumann (2005, 275–276, 278–285), Kopke and Schulz (2006).

[23]Bericht über die Eignung der Freskanpuder F 1000 und F 1001 zur Entgiftung und Behandlung von Lostschäden der Haut, December 21, 1939, secret, signed Lendle and Wirth, p. 3, BA-MA Freiburg, RH 12-23/1728.

[24]Ibid., pp. 4–5, BA-MA Freiburg, RH 12-23/1728.

[25]Ibid., p. 6, BA-MA Freiburg, RH 12-23/1728.

[26]Bericht über die Eignung der Freskanpuder F 1000 und F 1001 zur Entgiftung und Behandlung von Lostschäden der Haut, December 21, 1939, secret, signed Lendle and Wirth, pp. 3–4, BA-MA Freiburg, RH 12-23/1728.

[27]Interrogation of Wolfgang Wirth. Office of U.S. Chief of Council for War Crimes. Vernehmung No. 799 Dr. Wirth, February 12, 1947, p. 16, National Archives, Washington, RG 282, Microfilm M1019, roll 90; Klee (1997, 302); Kopke and Schultz (2001, 246, fn. 43).

prosecutor conducted a preliminary investigation of Schmick, including the human experiments on camp inmates with mustard gas, that Wirth admitted he had visited the camp and seen the victims in person. According to his statement from 1951, he had received an order by Generaloberstabsarzt Anton Waldmann in October or November 1939 to observe the experiments conducted in the concentration camp of Sachsenhausen. During his visit to Sachsenhausen, Wirth met with physicians who presented to him about "6, perhaps also 10 persons who had injuries approximately the size of the palm of the hand."[28] Wirth also remembered seeing a film screening at Sachsenhausen that documented the course of the disease on photographs. From what he had observed, Wirth drew the conclusion that he "could not determine a difference between persons who had been treated with the antitoxin and those who remained untreated" (Kopke and Schultz 2001, 249).

3.2 Natzweiler

3.2.1 The Sulphur Mustard Experiments of August Hirt

From 1942 to 1944 human experiments with sulphur mustard (aka LOST, named after their inventors Wilhelm LOmmel and Wilhelm STeinhaus) were conducted at the concentration camp Natzweiler on the initiative of August Hirt, SS-Sturmbannführer and director of the Anatomical Institute at the Reichsuniversität Straßburg (Mitscherlich and Mielke 1947, 92–98; Kater 1997, 248; Ebbinghaus 2000, 42–43; Steegmann 2005, 392–395; Schmaltz 2005, 531–535; Reitzenstein 2014, 131–149). In doing so, Hirt received support from the SS-Ahnenerbe. So as to gain more influence in the natural sciences, the SS-Ahnenerbe established in July 1942 the Institute for Military Scientific Research with the department "H" at the Reichsuniversität Straßburg—"H" as in Hirt.[29] Commissioned by the Wehrmacht in 1939, Hirt had already studied whether the intake or injection of vitamins or their application with an ointment offered a suitable therapy for treating severe skin lesions caused by LOST.[30] Supported by the SS-Ahnenerbe's General Secretary Wolfram Sievers, he succeeded in winning Himmler's approval for the LOST experiments.[31] In mid-July 1942 Himmler

[28]Regional court councilor Meyer (Der Untersuchungsrichter des Landgerichts Duisburg), Vernehmungsprotokoll von Wolfgang Wirth, August, 28, 1951, AMMS, JD 1/22, fol. 23–25; Kopke and Schultz (2001, 248–249), Woelk (2003, 277–278).

[29]Himmler to Sievers, July 9, 1942, BArch, R 26 III/729, fol. 195. For Hirt's biography, see Kasten (1991), Lachmann (1977), Wojak (1999), Lang (2004, 123 ff.), Uhlmann (2011), Uhlmann and Winkelmann (2015), Reitzenstein (2014, 105 ff.).

[30]Hirt, Bericht über Lost-Untersuchungen im Auftrag der Wehrmacht (copy), undated, BArch, NS 19/1582, fol. 46–49; Wolfgang Wirth, Re: Hirt: interrogation of 21.9.1945 (Major Tilley), September 22, 1945, The National Archives (Kew), FO 1041/104.

[31]Aktenvermerk zu den Forschungen von Hirt, June 26, 1942, BArch, NS 19/1209, pp. 5–8.

decreed that Hirt was to conduct his research assignments in connection with the concentration camp Natzweiler.[32] Following a visit by Hirt and Sievers to the concentration camp on August 31, 1942[33] the SS-Ahnenerbe administration began preparations for animal testing with LOST at Natzweiler in late September. Stables were set up, fodder provided, and stockbreeding developed.[34] The experimental toxicological und pharmacological research methodology used for chemical agents during World War I, whereby human experiments were preceded with a series of animal testing and their mutual findings correlated, was also applied at Natzweiler. In late October 1942 Sievers first ordered 20 g of LOST for Hirt from the Waffen-SS.[35] In mid-November, Hirt's assistant Karl Wimmer established a laboratory at Natzweiler and began to select inmates as test objects for the experiments.[36] The first LOST experiment conducted on November 25, 1942 on 15 inmates failed because the agent provided by the Waffen-SS proved to be ineffective.[37] In early December 1942 Hirt continued the experiments with a second delivery of LOST,[38] which did not, however, proceed as expected.[39] The results of the animal testing were not applicable to humans: Unlike the experiments on rats, the human experiments conducted on inmates showed that the Vitamin A treatment obviously did not induce protection, but quite the opposite, that is, hypersensitivity.[40] In late January 1943, Sievers and Hirt discussed at Natzweiler and Dachau the extension of the LOST experiments in both concentration camps. So as to elaborate valid regulations for the troop's treatment, a "major rat experiment" was to be conducted on 1000 animals. Subsequently, the therapeutic effect of four vitamins for the treatment of LOST injuries was to be examined on 240 KZ inmates.[41] Gerit Hendrik Nales, a former Dutch inmate who worked as an orderly at the Natzweiler sick bay from November 1942, testified during the Nuremberg Doctors' Trial that between April and May 1943 a blistering substance had been smeared on the

[32]Rudolf Brandt an Glücks, July, 13, 1942, BArch, NS 21/904 and Sievers, Aktenvermerk, November 3, 1942; BArch, NS 21/905.

[33]Aktenvermerk Sievers, September 17, 1942, BArch, R 26 III/729, fol. 133.

[34]SS-Obersturmbannführer Vogel to SS-Ahnenerbe, September 23, 1942 and Aktenvermerk Wolff, September 28, 1942, BArch, NS 21/904.

[35]Chef des Amtes Ahnenerbe to SS-Hauptsanitätslager der Waffen-SS, October 22, 1942, BArch, NS 21/905.

[36]Hirt to Sievers, November 13, 1942, BArch NS 21/905.

[37]Hirt: Versuchsbericht, November 30, 1942 and Hirt to Sievers, November 26, 1942, BArch, NS 21/905.

[38]Handschriftlicher Vermerk, December 4, 1942 concerning Hirt's "Bericht über die mit dem übersandten L-Stoff angestellten Versuche," November 30, 1942; SS-Ahnenerbe to SS-Hauptsanitätslagers der Waffen-SS, December 1, 1942; Vermerk über ein fernmündliches Gespräch mit Stabsarzt Dr. Wimmer, December 4, 1942; Wimmer, Empfangsbestätigung über 20 g Lost, December 4, 1942; Hirt to Sievers, December 22, 1942, BArch, NS 21/905.

[39]Hirt to Sievers, December 31, 1942, BArch, NS 21/905.

[40]Hirt an Sievers, January 6, 1943, BArch, NS 21/906.

[41]Sievers to Hirt, Bezug: Besprechungen am 25.1.1943 in Natzweiler, undated, BArch, NS 21/906.

forearms of 15 German inmates, inflicting "terrible, festering wounds" on the skin that spread to the whole body and caused some inmates to go blind.[42] According to Nales, three inmates died in horrible pain within a couple of days.[43] The symptoms described indicate LOST experiments. The names of the victims who died of edema of the lungs or pneumonia are known: on December 21, 1942 Karl Kirn; on December 28, 1942 Friedrich Karl Tries; and on December 31, 1942, Wilhelm Müssgen (Steegmann 2010, 425; Reitzenstein 2014, 141–142). In 1944, Hirt submitted a report summarizing the results of his LOST experiments in form of a proposal for a therapy of mustard gas wounds. His report did not mention the circumstances of the experiments conducted on concentration camp inmates or the suffering of the victims. He concluded that a mix of vitamins (A, B-complex, C) given orally, or Vitamin B-1 injected with glucose would give the best results (Fig. 3).[44]

3.2.2 The Phosgene Experiments of Otto Bickenbach

On 17 March 1943 the Institute for Military Scientific Research, mentioned above, invited selected scientists from the Reichsuniversität Strasburg's medical faculty to a conference.[45] One of the speakers was the physicist Otto Bickenbach—like Hirt an avid member of the NSDAP. Since 1939 Bickenbach had been researching possible treatments for the effects of the poison gas phosgene ($COCl_2$), which was used in combat during World War I. He had tested on animals the possible therapeutic and prophylactic effects of hexamethylenetetramine against pulmonary edema caused by phosgene poisoning (Schmaltz 2005, 521–562; 2006a). Schering AG marketed this medicine under the brand name Urotropin to treat cystitis and meningitis (Schmaltz 2005, 524). Due to the results of the animal testing, Bickenbach considered Urotropin "a very efficient protectant against the suffocation symptoms caused by the phosgene poisons."[46] At the conference, hosted by the SS-Ahnenerbe, Bickenbach screened a film he had shot himself to document the phosgene experiments conducted on cats and apes up to 1940.[47] In consequence, Sievers suggested that Bickenbach continue his experiments "in connection" with Hirt in Natzweiler.[48] Bickenbach agreed to the cooperation with

[42]Affidavit Gerrit Hendrik Nales, NO-1063, in Dörner et al. (2000b, microfiche 3/01640f).

[43]Interrogation of Gerrit Hendrik Nales on June 30, 1947. Trial transcript, Dörner et al. (2000b, microfiche 2/10586 ff. and 2/10594).

[44]Hirt and Wimmer, Behandlungsvorschlag für Kampfstoffverletzungen mit Lost, 1944 (=NO-99), BArch, NS 19/1582, fol. 74–76.

[45]Sievers, Aktenvermerk zu der Konferenz vom 17.3.1943, April 5, 1943, BArch, NS 21/906.

[46]Französische Republik. Ständiger Militärgerichtshof des sechsten Bezirks in Strassburg. Trial proceedings, May 6, 1947, NO-3848, Dörner et al. (2000a, microfiche 3/2529).

[47]Aktenvermerk von Sievers zu einer Unterredung mit Bickenbach am 17.3.1943 über Kampfstoff-Forschung, April 5, 1943, BArch, NS 21/906.

[48]Ibid.

Fig. 3 August Hirt "Reichsuniversität Straßburg" (© Hans-Joachim Lang)

the SS because it gave him access to a large number of KZ inmates as test objects for his experiments. In early April 1943 Sievers asked camp commander Josef Kramer about the exact spatial volume of the gas chamber under construction there so that Bickenbach could calculate the gas concentration and thus the phosgene dose required for the human experiments.[49] On April 12, 1943 Kramer reported that the gas chamber was now "completed" and had "a spatial volume of 20 cubic meters."[50] In mid-September 1942 Bickenbach agreed to cooperate with a working group at the Institute for Military Scientific Research.[51] Two days after receiving the news concerning the operative gas chamber in Natzweiler, Sievers reported to Himmler in person the results of Hirt's LOST experiments so far. Bickenbach was

[49]Sievers to Commander of the concentration camp Natzweiler, April 5, 1943, BArch, NS 21/906.

[50]Kramer to SS-Ahnenerbe, Betr.: G-Zelle im KL Natzweiler, April 12, 1943, BArch, NS 21/906. Kramers specifications are not precise. In 1946, the gas chamber of the camp had been examined technically by a French commission of experts. The floor plan measured 2.40 × 3.50 m with a ceiling height of 2.60 m. The volume therefore was 21.84 m^3. See Camp de Concentration du Struthof. Rapport d'expertise de MM. les professeurs et docteurs Simonin (Strasbourg), Piédelièvre (Paris) Docteur Fourcade (Strasbourg), January 15, 1946, BArch Ludwigsburg, B 162/335, fol. 66.

[51]Sievers, Aktenvermerk, September 17, 1942, BArch, R 26 III/729, fol. 122.

then also asked to "deliver a short report about the resistance to, or the rejection of his phosgene experiments and defense proposals by the Wehrmachtdienststellen."[52] Two weeks later, Hirt informed Bickenbach that the experiments under his responsibility could now begin. Consistent with the statement of Ferdinand Holl, a political prisoner who served as *kapo* (prisoner functionary) in the Natzweiler barrack reserved for the SS-Ahnenerbe, the first phosgene experiments took place in June 1943. According to his estimate, approximately 90 to 150 inmates were subjected to phosgene—50 to 60 of whom suffocated in agony.[53] Contradictory statements by Holl regarding the number of subjects involved and the number of victims who died, as well as the question of whether this early series had actually taken place, are still being discussed among historians today.[54]

3.2.3 New Series of Phosgene Experiments in June and August 1944

In 1944 the Natzweiler gas chamber was used again for several test series with phosgene.[55] Helmut Rühl, Bickenbach's assistant, was responsible for the measurement of phosgene concentration in correlation to the humidity of the gas chamber.[56] Rühl began to work on the construction apparatus for the measurements in January 1944 but had difficulties with the calibration of the instruments.[57] The measuring method used by Rühl had been developed by Wolfgang Wirth, head of the Institute for Pharmacology and Military Toxicology of the Military Medical Academy in Berlin (Wirth 1936). Wirth visited Rühl in Strasburg and gave him advice on the final adjustment of the instruments before the last series of phosgene experiments began at Natzweiler.[58] Although we do not know how much Wirth learned about the experiments conducted in the concentration camp at Natzweiler, his technical support may be seen as further

[52]Sievers to Hirt, April 14, 1943, BArch, NS 21/906.

[53]The number of test victims can no longer be clearly established. In the Nuremburg Doctor's Trial, Ferdinand Holl first gave the number as 150 victims. During cross-examination, he stated that he had witnessed about four series of experiments with LOST, each involving 30 inmates (i.e., a total of 120 inmates). According to Holl, each test series led to 7–8 casualties. Regarding the phosgene experiments, he confirmed three series, each with 30 inmates (i.e. altogether 90 victims). Cf. interrogation of Ferdinand Holl on January 6, 1947, Wortprotokoll, in Dörner et al. (2000a, microfiche 2/01092-01096).

[54]The testimonies of Holl have been reviewed and analyzed, Reitzenstein (2014, 134, 141–142, 168–169, 358 fn. 1007). See also Schmaltz (2005, 535 and 561), Steegmann (2005, 394–395).

[55]The implementation of the experimental series was delayed due to a conflict between Hirt and Bickenbach, see Schmaltz (2005, 538–543).

[56]Dr. Helmut Rühl an Karl Brandt, 2. Bericht: Untersuchungen über den Konzentrationsabfall des Phosgens in der Verwendeten Kammer und seine Hydrolyse unter Einfluss der Luftfeuchtigkeit, undated, NO-1852, Dörner et al. (2000a microfiche 3/02775-02777).

[57]Bericht von Dr. Helmut Rühl über seine Tätigkeit an dem Forschungsinstitut der Medizinischen Fakultät Straßburg, [1950], p. 2, The National Archives (Kew), FO 1060/570.

[58]Helmut Rühl to Karl Brandt, 2. Bericht: Untersuchungen über den Konzentrationsabfall des Phosgens in der Verwendeten Kammer und seine Hydrolyse unter Einfluss der Luftfeuchtigkeit, undated, NO-1852, Dörner et al. (2000a, microfiche 3/02775).

evidence of scientific networks linking the human experiments of the Wehrmacht to criminal human experiments.[59] On June 14, 1944 Bickenbach's assistants Helmut Rühl and Fritz Letz went to Natzweiler to equip the gas chamber with the measuring apparatus. Hirt and Bickenbach followed the next day and began with the phosgene experiments which ended on August 8, 1944.[60] Twelve of the 40 inmates involved in the experiments were forced to take Urotropin orally; 20 inmates received injections and a "control group" of eight inmates remained "unprotected."[61] Apart from some "preventive detained" German inmates, most of the test victims had been transferred by the SS from the "Gipsy camp" Auschwitz-Birkenau to Natzweiler. The inmates had to report in groups of four to the experiments. The phosgene dose was gradually increased from experiment to experiment, while the dose of Urotropin was simultaneously reduced. Willy Herzberg, one of the survivors, told how Bickenbach himself led the inmates into the gas chamber, where he smashed vials filled with phosgene on the ground. Bickenbach then left the gas chamber and subsequently the doors were locked. After ten minutes in the gas chamber, Herzberg heard a "muffled splashing" caused by the "bursting lungs" of his fellow prisoners, who broke down with foam in their mouths, noses, and ears.[62] His own breathing became distressed and he had the feeling as if "someone was sticking needles into his lungs." On his chest he sensed "a pressure, as if hundreds of kilos were put upon it," and he "already thought that he would not survive this."[63] According to Bickenbach's final report, 14 inmates sustained pulmonary edema of varying degrees during the test series. In the final series, the established lethal dose of phosgene was considerably exceeded (Fig. 4).

All four inmates (Zirko Rebstock, 37; Adalbert Eckstein, 20; Andreas Hodosy, 32 and Josef Reinhardt, 38), who died at the end of the last test series, were German Sinti—thus indicating a systematic selection of victims based on racist criteria for the most perilous experiment. In his final report to Karl Brandt in 1944, Bickenbach explained in detail the degree to which the limit values of the lethal effects of phosgene poisoning could be reduced with Urotropin.[64] The phosgene experiments at Natzweiler show that human experiments, which were unethical and without doubt a medical war crime, could still produce new scientific insights. The transgression of ethical boundaries, making the death of the test subjects an integral part of the epistemology of the

[59]When interrogated in 1947, Wirth claimed that he had not heard of the phosgene experiments in Natzweiler before the Nuremberg War Crime Trials (Woelk 2003, 282). Eidesstattliche Erklärung von Wolfgang Wirth, February 2, 1947, VDB Nachtrag 1 (Hanloser), Dörner et al. (2000a, microfiche 4/4171-4173).

[60]Staatsanwaltschaft Bochum: Vernehmungsprotokoll von Otto Bickenbach, November 4, 1955, BArch Ludwigsburg, B 162/4206, fol. 1093f.

[61]Bickenbach to Karl Brandt: 7. Bericht. Die schützende Wirkung einer Inhalation von Hexamethylentetramin-Aerosol auf die Phosgenvergiftung, undated, p. 15, NO-1852, Dörner et al. (2000a, microfiche 3/02791).

[62]Staatsanwaltschaft Holtfort: Zeugenvernehmung von Willy Herzberg, July, 1, 1981, BArch Ludwigsburg, B 162/19282, fol. 80.

[63]Ibid., 81.

[64]Bickenbach to Brandt, 7. Bericht, undated, NO-1852, (Dörner et al. 2000a, microfiche 3/02794).

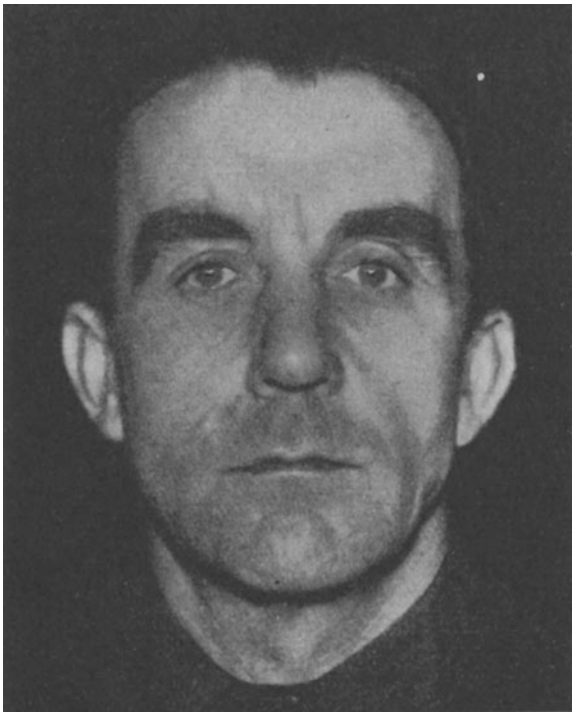

Fig. 4 Otto Bickenbach in French imprisonment (Bayle 1950, 925)

experiments in the context of brutal and dehumanized medicinal practice, delivered empirical data that could not have been obtained under any other circumstances.

3.3 Neuengamme

The last series of experiments with chemical warfare agents in a concentration camp took place between December 1944 and March 1945 at Neuengamme (Groehler 1978, 277–279; 1989, 240–242; Klee 1997, 177–179; Kalthoff and Werner 1999, 193–196). They were initiated by the head of the Reichsanstalt für Wasser- und Luftgüte, Professor Karl Ludwig Werner Haase (Fig. 5).[65]

[65]Karl Ludwig Werner Haase (1903–1980) studied chemistry in Berlin, where he also worked on his dissertation at the Kaiser Wilhelm Institute für physical Chemistry and Electro Chemistry. He completed this in 1924 at the Institut for Plant Nutrition (Institut für Pflanzenernährung) in Hohenheim. In 1925 he received his doctorate in Berlin and started to work for the Preußische Landesanstalt für Wasser-, Boden- und Lufthygiene (in 1942 renamed Reichsanstalt für Wasser- und Luftgüte). Haase joined the NSDAP in April 1940. During World War II he was a member of a commission of the Speer Ministry (Reichsministerium für Rüstung- und Kriegsproduktion) that dealt with development of mobile drinking water devices. See Affidavit Werner Haase, January 27,

Fig. 5 Ludwig Werner Haase (Werkstoffe und Korrosion, 6. Jg., 1955, 2. Innenseite: "Die Vortragenden der Korrosionstagung/DECHEMA-Jahrestagung—11. und 12. November 1954 in Frankfurt/Main")

Following the destruction of the large water dam "Möhne Reservoir" by a Royal Air Force air raid in May 1943, Haase was assigned as a consultant for its restoration. Once he had alerted the president of the Reichsanstalt to the possible risk of the Allied Forces contaminating the water with bacteria, glass dust, viruses, or chemical agents, Haase was authorized to explore new decontamination methods for chemical agents in laboratory research.[66] In spring 1944 Haase advanced a new method for the decontamination of water that had been poisoned with the blister agent Lewisite [$C_2H_2AsCl_3$; dichloro(2-chlorovinyl)arsine]. This involved the

(Footnote 65 continued)

1947, VDB 1, Dörner et al. (2000a, microfiche 3/4996); BArch, NSDAP Ortsgruppenkartei, Haase, Ludwig Werner, born May 2, 1903. See also the entries on Haase in Kürschners Gelehrten-Lexikon, Oestreich (1954, 761), Schuder (1961, 633–634; 1970, 945).

[66]Aussage von Ludwig Werner Haase, November 21, 1963, BArch Ludwigsburg, B 162/1001, fol. 365–366.

application of hypochlorous acid.[67] The organic arsenic agent Lewisite, produced as a chemical weapon during World War I, causes severe blistering and burns, resulting when ingested in great pain, nausea, vomiting, and tissue damage (Pechura and Rall 1993; Bey and Walter 2003). The Wehrmacht immediately tested Haase's method at Raubkammer/Munsterlager.[68] Within the Military Medical Academy, Haase's method was controversial because the first results of the decontamination experiments were ambiguous.[69] In summer 1944 the Institute for Pharmacology and Military Toxicology headed by Wolfgang Wirth investigated the toxicity of Lewisite decomposition products.[70] By the end of August 1944, the apparatus for the decontamination process was available.[71] In late September 1943 the president of the Reichsanstalt für Wasser- und Luftgüte sent a copy of Haase's preliminary report to the head of the Ministry of Interior's health department, Fritz Cropp, who in turn forwarded it to Reich Health Leader Leonardo Conti.[72] SS-Obergruppenführer Conti immediately submitted the report to Himmler asking for support to further develop the new method of decontamination since traditional procedures would fail due to the insufficient availability of active charcoal for such large amounts of water.[73] Himmler authorized experiments in a concentration camp and Neuengamme was chosen as the location.[74]

Haase and his assistant Dr. Jaeger had been preparing the experiments since June 1944 and planned to install the decontamination apparatus by the end of July at the Neuengamme concentration camp. On August 5 and September 1, 1944 they visited

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[67]Ibid.

[68]Ibid.

[69]While the head of the Institut für Wehrpharmazie und angewandte Chemie, Konrad Gemeinhardt, pled against follow-up studies, the head of the Institut für Pharmakologie und Wehrtoxikologie, Wolfgang Wirth, recommended further investigations. See Hemmrich (Der Sonderbeauftragte des Reichsministers für Rüstung und Kriegsproduktion für die Entseuchung und Entgiftung von Trink- und Brauchwasser: Niederschrift über die Besprechung am 28.4.1944, May 5, 1944, p. 3, BA-MA Freiburg, RH 12-23/1707.

[70]OKH Chef H Rüst u SAN (Nr 93601 44 g S In II G III) to Ministerialrat Georg Hemmrich, Betr.: Genußfähigkeit arsenhaltigen Trinkwassers, August, 28, 1944, BA-MA Freiburg, RH 12-23/1707 and Wirth to Zettel (Generalkommissar des Führers für das Sanitäts- und Gesundheitswesen), Betr.: Kampfstoffentgiftung von Wasser (draft), secret, August 24, 1944, ibid.

[71]Zettel to Wirth, August 19, 1944, BA-MA Freiburg, RH 12-23/1707 and Wirth to Zettel, August 24, 1944, ibid.

[72]Reichsanstalt für Wasser- und Luftgüte to Ministerialdirektor Dr. Cropp, September 27, 1943, BArch, NS 19/3819, fol. 2 and Rudolf Brandt (Personal Staff RFSS) to Reichsarzt-SS und Polizei Dr. Grawitz, October 8, 1943, ibid., fol. 3.

[73]Conti to Himmler, October 1, 1943, BArch, NS 19/3819, fol. 1. In 1944, the shortage of active charcoal was so severe that the army could not meet its demands for gas mask filters, see Schreiben der Heeres-Rohstoffabteilung unter Az. 66 b 91.30 H Ro Va zu Nr. 99/44 v. 22.8.44 to San In./Org II, Betr.: Trinkwasser und Entgiftung (Geheime Kommandosache), BA-MA Freiburg, RH 12-23/1707.

[74]Rudolf Brandt to Reichsarzt-SS und Polizei Dr. Grawitz, October 8, 1943, BArch, NS 19/3819, p. 3; Rudolf Brandt to Conti, October 3, 1943, ibid., p. 4 and Grawitz to Rudolf Brandt, March 30, 1944, ibid., p. 6.

Neuengamme.[75] Probably on one of these days, hypochlorous acid was added to the drinking-water supply at Neuengamme to perform a large-scale test on approximately 10,000 inmates to see if the water with the added decontamination compound would lead to health problems.[76] According to Haase and Regierungsbauinspektor Kumpfert, no observed health problems were reported after consumption of the water with the decontamination compound.[77] On October 10, 1944 Haase continued testing with Wolfgang Wirth from the Military Medical Academy at the army's proofing ground at Raubkammer.[78]

In November the Personal Staff of Reichsführer SS asked for the promised results.[79] By the end of November, Haase announced that he and his research assistant Dr. Jaeger would prepare and conduct the experiments at Neuengamme. Haase attributed the delay of the experiments to the difficulties presented by the required physiological pre-examinations conducted by the director of the Pharmacological Institute Felix Haffner at the University of Tübingen, as well as the results of other institutes at Dresden, Hamburg, Raubkammer, and Wuppertal regarding a possible effect of poor water quality on the results.[80] Haffner's research project was authorized by the Heereswaffenamt and furthered by the Reich Research Council (Fig. 6).[81]

By the end of November Helmut Poppendick, Chief of Personal Staff of the Reichsführer SS and Police, acting as designated principal investigator at Neuengamme, characterized the human experiments at Neuengamme as a "control experiment on a large scale for a final assurance" of the decontamination method,

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[75]See the Tagesjournal der Reichsanstalt für Wasser- und Luftgüte, daily journal entries dating June 7, July 28.7. August 5, and September 1, 1944, Archiv des Umweltbundesamtes, Tagesjournale. I am grateful to Dr. Karsten Linne who informed me about these documents.

[76]Grawitz telexed to Rudolf Brandt on September 8, 1944 that the hypochlorous acid had proven harmless ("WIRKSAEURE IN DEN NOTWENDIGEN KONZENTRATIONEN KEINE GESUNDHEITSCHAEDIGUNG VERUSACHT") and that new experiments with chemical agents would start now (Telex Grawitz to Rudolf Brandt, September 8, 1944, BArch, NS 19/3819, fol. 8). For the number of concentration camp inmates exposed to the detoxification acid, see Friedrich Konrich (Präsident der Reichsanstalt für Wasser- und Luftgüte). Berichterstatter Haase und Regierungsbauinspektor Kumpfert: 13. Bericht über die Wirkung hoher W-Säurekonzentrationen im Wasser auf Menschen und Tiere, October 26, 1944, Staatsarchiv Nürnberg, KV-Anklage, Dokumente, NO-153.

[77]13. Bericht über die Wirkung hoher W-Säurekonzentrationen im Wasser auf Menschen und Tiere, October 26, 1944, Staatsarchiv Nürnberg, KV-Anklage, Dokumente, NO-153.

[78]Wirth (Wi G III) to Org II, Betr.: Entgiftung von Trinkwasser, (draft), October 31, 1944, BA-MA Freiburg, RH 12-23/1707 and Wirth to Karl Brandt, Betr.: W-Säureverfahren von Prof. Haase, December 13, 1944, BA-MA Freiburg, RH 12-23/1740.

[79]Telex from Rudolf Brandt to Poppendick, November 3, 1944, BArch, NS 19/3819, fol. 9.

[80]Haase spoke of the "Außenstellen in Dresden, Hamburg, Raubkammer und Wuppertal." Except for the Heeresversuchsanstalt at Raubkammer, it is not clear which laboratories he meant, see Haase: Aktenvermerk, November 22, 1944, BArch, NS 19/3819, fol. 11.

[81]For Haffner's research project, see Felix Haffner, Wasserentgiftungsmethoden (Kampfstoffe). Pharmakologisches Institut Universität Tübingen. OH-09/0012—DE-009/752/43 Gkdos. Oberregierungsrat Dr. Wagner. approved September 1943, BArch, R 26 III/12.

Fig. 6 Helmut Poppendick, November 5, 1947 at Nuermberg (Courtesy of the United States Holocaust Memorial Museum, Photograph #07322)

since Haase and his collaborators had allegedly already continuously drunk the decontaminated water without suffering any health damages. By that time, 1200 units of the decontamination apparatus were already in production.[82] In early December 1944 Karl Brandt asked Wirth for a statement on the Haase method.[83] Wirth was not able to provide an evaluation report since he had not received the relevant report from Haase. Complaining about an insufficient supply of research data, Wirth conducted comprehensive toxicological and pathohistological experiments to establish an empirical basis for the evaluation of Haase's methods. Wirth promised to submit a report to the Reichsführer SS by mid-December 1944 (Table 3).[84]

Between December 3 and 15, 1944 approximately 150 inmates of a so-called "Schonbaracke (recovery barrack) at Neuengamme were subjected to the drinking water experiments. According to Haase's report, the water had first been poisoned with Lewisite for 15 days, with doses increasing in rates of up to a maximum of

[82]Helmut Poppendick to Rudolf Brandt, November 23, 1944, BArch, NS 19/3819, fol. 10.

[83]Karl Brandt to Wirth, December 6, 1944, BA-MA Freiburg, RH 12-23/1740.

[84]Wirth to Karl Brandt, Betr.: W-Säureverfahren von Prof. Haase, December 13, 1944, BA-MA Freiburg, RH 12-23/1740.

Table 3 Lewisite and mustard gas experiments at the concentration camp Neuengamme

Date	Agent	Number of test persons	Involved
5 Aug. and 1 Sept.1944	Hypochlorous acid (compound for decontamination)	Approx. 10,000 concentration camp inmates	Haase Jaeger
3 Dec.–12 Dec.1944	Lewisite	Approx. 150	
	Dora (Lewisite dry)		
	Nitrogen mustard		
Planned in Feb.1945	8 CW agents	16 planned	Poppendick
	Nitrogen mustard		

"approximately 100-fold" the amount the Military Medical Academy considered noxious.[85] Purportedly, the SS camp physicians did not observe any health damage in the camp prisoners.[86] The experiments included two different agents: Lewisite and Dora (a dry form of Lewisite) were used. SS-Oberführer Helmut Poppendick concluded from Haase's report that further experiments in January were necessary to establish possible damage caused by long-term consumption of the water since the amount of arsenic ingested was still considered "significant."[87] However, Himmler did not consider further experiments necessary since the dosage tested had been high enough.[88] Haase and SS-Sturmbannführer Hermann Friese, who acted as an expert consultant for the SS in issues of chemical warfare, favored further experiments after hearing about Himmler's skeptical appraisal. He argued that additional experiments with nitrogen mustard gas were necessary because this agent had a different chemical composition and reaction than Lewsiste, the arsenic compound tested so far. The experiments with nitrogen mustard were conducted in January 1945.[89] In February 1945 Poppendick reported that the nitrogen mustard experiments had been completed and achieved the "same favorable result."[90]

As stated in a final report by the Reichsanstalt für Wasser- und Lufthygiene in March 1945, this series of tests with nitrogen mustard gas had actually been initiated by Wolfgang Wirth during a meeting with Karl Brandt as early as December 4, 1944, one day after the experiments on concentration camp inmates had begun.[91]

[85]The report written by Haase is quoted in the letter from SS-Oberführer Poppendick (Reichsführer-SS—Reichsarzt-SS und Polizei) to Rudolf Brandt, December 20, 1944, BArch, NS 19/3819, fol. 12.

[86]Ibid.

[87]SS-Oberführer Poppendick to Rudolf Brandt, December 20, 1944, BArch, NS 19/3819, fol. 12.

[88]Rudolf Brandt to Poppendick, December 31, 1944, BArch, NS 19/3819, fol. 13.

[89]For the academic career of Friese, see also Albrecht et al. (1991, 74).

[90]Poppendick to Rudolf Brandt, February 8, 1945, BArch, NS 19/3819, 15.

[91]Konrich (Präsident der Reichsanstalt für Wasser- und Luftgüte). Berichterstatter: Dr. Jaegers und Regierungs-Bauinspektor Kumpfert. Bericht Nr. 25 über die in Hamburg-Neuengamme durchgeführten Versuche vom 30.3.1945, in Staatsarchiv Nürnberg, KV-Anklage, Dokumente, NO-154.

In an affidavit for the defense in the Nuremberg Doctors' Trial, Wirth confirmed that he probably attended a meeting in Brandt's office on December 12, 1944 when two devices for the decontamination of water poisoned with chemical agents were discussed. Wirth denied having given advice to extend the experiments with nitrogen mustard.[92] Though the report by Konrich gives no evidence that Wirth personally visited Neuengamme, or that he participated directly in the experiments, his advice, however, led to its implementation in January 1945 when inmates were forced to drink decontaminated water that had been previously poisoned with nitrogen mustard gas. This shows that the chemical warfare researchers from army agencies were not only aware of the unethical experiments undertaken in German concentration camps, but were actually involved as expert consultants in the specific division of labor for the SS physicians in the camps.

After the nitrogen mustard experiments were completed in early February 1945, the scientists proposed another series of experiments with a far more radical approach to forced human participation. The experimental design now not only included intentional health damage and disabilities, but even the death of camp inmates. Poppendick urged that the ingestion of chemical agents be examined in more detail since all available data on harmful doses were "nothing but a pure guess."[93] According to Poppendick's letter, Haase wanted to force eight concentration camp inmates to ingest eight important chemical agents in harmful doses, and another eight inmates to ingest a lower dose that he considered harmless, in order to determine the threshold: "Since damage or cases of death do not have to be taken into account for the first eight test persons, prisoners facing death sentences should be used."[94]

On February 16, 1945 Himmler withdrew his approval "in consideration of the current situation."[95] This was, as far as we know, the first time ever that Himmler refused to allow human experiments to be conducted in a concentration camp. Even with the advance of the Allied Forces and Germany's final defeat unavoidable, the scientists still tried to make use of the last opportunity to exploit the lives of the concentration camp inmates at their disposal and ruthlessly subjected them to lethal

[92]Eidesstattliche Erklärung von Wolfgang Wirth, Feb. 2, 1947, VDB Nachtrag 1 (Hanloser), Dörner et al. (2000a, microfiche 4/4171-4173). Woelk (2003, 282) does not discuss the reliability of Wirth's affidavit. As Kopke and Schultz have shown, Wirth committed perjure when he denied under oath that he had absolutely no knowledge of human experiments in German concentration camps, see Kopke and Schultz (2001, 247–249), Schmidt (2007, 295). Karl Brandt and Siegfried Hanloser denied any specific knowledge of the involvement of Wirth in the water decontamination experiments at Neuengamme: Kreuzverhör von Karl Brandt (34. Verhandlungstag), February 2, 1947, Microfiche-Edition Ärzteprozess, Dörner et al. (2000a, microfiche 2/02654-2655); Kreuzverhör Siegfried Hanloser (39. Verhandlungstag), February 18, 1947, ibid., microfiche 2/03057-3059.

[93]Poppendick to Rudolf Brandt, February 8, 1945, BArch, NS 19/3819, fol. 15.

[94]Ibid.

[95]Handwritten note by Rudolf Brandt from February 16, 1945, see Poppendick to Rudolf Brandt, February 8, 1945, BArch, NS 19/3819, fol. 15.

human experiments. In March 1945 Dr. Jaeger visited Neuengamme again.[96] Whether his intention was to retrieve the decontamination apparatus or to conduct the final experiments remains unclear.

4 Conclusion

Concerning the issue of the informed consent of subjects on whom experiments with chemical agents were performed, the crucial question of voluntary participation and informed consent mark an important difference between those experiments conducted under the auspices of military institutions, or those that took place in the concentration camps. While the former provided some room for manoeuvre, this was not the case in the concentration camps. For those experiments, there was no informed consent and no attempts were made to avoid the unnecessary suffering. The experiment designs of August Hirt, Otto Bickenbach, and Ludwig Haase took the death of involuntary test persons into account. In the case of Haase, it was only the impending military defeat of Nazi Germany that fortunately inhibited the implementation of the last deadly series of experiments.

Cooperation, competition, and division of labor went hand in hand. As the examples presented here have shown, competition and rivalry between chemical warfare experts from the military and the SS led to a specific division of labor in human experimentation with chemical agents. Plans to conduct the human experiments in concentration camps were not always initiated by the SS, August Hirt, or Helmut Poppendick. As the cases involving airforce officers Bickenbach and Haase from the Reichsanstalt für Wasser- und Luftgüte show, scientists from other groups and institutions, in addition to the SS, were also driving forces in conducting criminal experiments on decontamination methods for drinking water poisoned with chemical agents. Sources indicate that it is also likely that Wolfgang Wirth, head of the Institute for Pharmacology and Military Toxicology of the Military Medical Academy, proposed to expand those experiments on concentration camp inmates at Neuengamme to investigate nitrogen mustard.

For a better understanding of human experimentation during the Nazi regime, it is crucial to analyze historically the epistemology of human experimentation and to take seriously the research motivation and aims of the scientists involved. Knowledge production and dissemination of human experimentation with chemical agents was not restricted to SS doctors, but included a much broader group of scientists in the army and airforce, at universities, in research organizations such as the renowned Deutsche Forschungsgemeinschaft and the Reich Research Council, or at the Reichsanstalt für Wasser und Luftgüte.

[96]Eintrag Nr. 35/2 zu den Reisekosten Jaegers nach Hamburg-Neuengamme vom 6.3.1945 im Tagesjournal 1945 der Reichsanstalt für Wasser- und Luftgüte, Archiv des Umweltbundesamtes, Tagesjournale. I would like to thank Dr. Karsten Linne, who found this document, for generously supplying a copy.

References

Albrecht, Helmuth, Bettina Gundler, and Technische Universität Braunschweig. 1991. *Catalogus professorum der Technischen Universität Carolo-Wilhelmina zu Braunschweig*. Beiträge zur Geschichte der Carolo-Wilhelmina 9. Braunschweig.

Baader, Gerhard. 2002. Lost-Levisit-Kampfstoffversuche in der deutschen Militärmedizin, 1939–1945. *Virus. Beiträge zur Sozialgeschichte der Medizin* 3: 12–28.

Bayle, François. 1950. *Croix gammée contre caducée. Les expériences humaines en Allemagne pendant la deuxième guerre mondiale*. Neustadt: Centre de L'Imprimerie Nationale.

Bey, Tareg, and Frank G. Walter. 2003. Senfgas, Stickstofflost, Lewisit und Phosgenoxim. Hautschädigende Militärkampfstoffe und deren Bedeutung für Rettungsdienste. *Notfall & Rettungsmedizin* 6(5): 327–336.

Brauch, Hans Günter, and Rolf Dieter Müller. 1985. *Chemische Kriegführung—Chemische Abrüstung. Dokumente und Kommentare*. Berlin: Arno Spitz Verlag.

Czernik, Hendryk. 1974. Filie obozu koncentracyjnego Gross-Rosen w Brzegu Dolnym (Dyhernfurth I i II). *Studia nad faszyzmem i zbrodniami hitlerowskimi*, 191–248.

Dörner, Klaus, Angelika Ebbinghaus, Karsten Linne, Karl Heinz Roth, and Paul Weindling. 2000a. *Der Nürnberger Ärzteprozeß 1946/47. Wortprotokolle, Anklage- und Verteidigungsmaterial, Quellen zum Umfeld*. München: K.G. Saur.

Dörner, Klaus, Angelika Ebbinghaus, Karsten Linne, Karl Heinz Roth, and Paul Weindling. 2000b. *Der Nürnberger Ärzteprozeß 1946/47. Wortprotokolle, Anklage- und Verteidigungsmaterial, Quellen zum Umfeld*. Erschließungsband zur Mikrofiche-Edition: Bearbeitet von Karsten Linne. München: K.G. Saur.

Ebbinghaus, Angelika. 1998. Der Prozeß gegen Tesch & Stabenow. Von der Schädlingsbekämpfung zum Holocaust. *1999. Zeitschrift für Sozialgeschichte des 20. und 21. Jahrhunderts* 13(2): 16–71.

Ebbinghaus, Angelika. 1999. Chemische Kampfstoffe in der deutschen Rüstungs- und Kriegswirtschaft. In *Krieg und Wirtschaft. Studien zur deutschen Wirtschaftsgeschichte 1939–1945*, ed. Dietrich Eichholtz, 171–194. Nationalsozialistische Besatzungpolitik in Europa 1939–1945. Berlin: Metropol-Verlag.

Ebbinghaus, Angelika. 2000. Einleitung. In *Der Nürnberger Ärzteprozeß 1946/47. Wortprotokolle, Anklage- und Verteidigungsmaterial, Quellen zum Umfeld*. Erschließungsband zur Mikrofiche-Edition, eds. Klaus Dörner, Angelika Ebbinghaus, Karsten Linne, Karl Heinz Roth, and Paul Weindling. Bearbeitet von Karsten Linne, 11–69. München: K.G. Saur.

Eberle, Henrik. 2015. *Ein wertvolles Instrument. Die Universität Greifswald im Nationalsozialismus*. Köln: Böhlau.

Gellermann, Günther W. 1986. *Der Krieg, der nicht stattfand. Möglichkeiten, Überlegungen und Entscheidungen der deutschen Obersten Führung zur Verwendung chemischer Kampfstoffe im zweiten Weltkrieg*. Koblenz: Bernhard & Graefe Verlag.

Grodin, Michael A. 1992. Historical Origins of the Nuermberg Code. In *The Nazi Doctors and the Nuremberg Code. Human Rights in Human Experimentation*, eds. George J. Annas, and Michael A. Grodin, 121–144. New York: Oxford University Press.

Groehler, Olaf. 1978. *Der lautlose Tod*. Berlin (DDR): Verlag der Nation.

Groehler, Olaf. 1989. *Der lautlose Tod. Einsatz und Entwicklung deutscher Giftgase von 1914 bis 1945*. Reinbek: Rowohlt.

Groehler, Olaf. 1992. *Selbstmörderische Allianz. Deutsch-russische Militärbeziehungen 1920–1941*. Berlin: Vision Verlag.

Hahn, Judith. 2008. *Grawitz, Genzken, Gebhardt. Drei Karrieren im Sanitätsdienst der SS*. Münster: Klemm & Oelschläger.

Hayes, Peter Francis. 2004. *From cooperation to complicity. Degussa in the Third Reich*. Cambridge: Cambridge University Press.

Joly, Hervé. 2000. L'implication de l'industrie chimique allemande dans le Shoah: Le cas de Zyklon B. *Revue d'histoire moderne et contemporaire* 47 (April–Juni): 368–400.

Jones, Irving H. 1945. *I.G. Farbenindustrie A.G. Frankfurt/Main*. CIOS File No. XXX-19 (Item 30), ed. SHAEF Combined Intelligence Objectives Sub-Committee—G-2 Division.

Kalthoff, Jürgen, and Martin Werner. 1999. *Die Händler des Zyklon B*. Hamburg: VSA Verlag.

Kasten, Frederick H. 1991. Unethical Nazi Medicine in Annexed Alsace-Lorraine: The Strange Case of Nazi Anatomist Professor Dr. August Hirt. In *Historians and archivists. Essays in modern German history and archival policy*, ed. G.O. Kent, 173–208. Fairfax, Va.: George Mason University Press.

Kästner, Ingrid, and Susanne Hahn. 1994. Der Toxikologe Otto Muntsch (1890–1945) und die deutsche Kampfstofforschung. *1999. Zeitschrift für Sozialgeschichte des 20. und 21. Jahrhunderts* 9(3): 42–50.

Kater, Michael H. 1997. *Das "Ahnenerbe" der SS 1935–1945. Ein Beitrag zur Kulturpolitik des Dritten Reiches*, 2nd ed. Studien zur Zeitgeschichte 6. München: R. Oldenbourg.

Klee, Ernst. 1997. *Auschwitz, die NS-Medizin und ihre Opfer*. Frankfurt am Main: S. Fischer Verlag.

Klee, Ernst. 2001. *Deutsche Medizin im Dritten Reich. Karrieren vor und nach 1945*. Frankfurt am Main: Fischer Verlag.

Kopke, Christoph, and Gebhard Schultz. 2001. Menschenversuche mit chemischen Kampfstoffen bei der Wehrmacht und SS. Ein Forschungsbericht. In *Medizin und Verbrechen. Festschrift für Walter Wuttke*, ed. Christoph Kopke, 239–257. Ulm: Klemm & Oelschläger.

Kopke, Christoph, and Gerhard Schulz. 2006. Die Menschenversuche mit dem Kampfstoff Lost im KZ Sachsenhausen (1939) und die Debatte über die Rolle des Wehrmachtstoxikologen Wolfgang Wirth. In *Medizin im Zweiten Weltkrieg*, ed. Wolfgang U. Eckart, and Alexander Neumann, 113–129. Paderborn: Schönigh.

Krause, Joachim, and Charles K. Mallroy. 1993. *Chemische Waffen in der Militärdoktrin der Sowjetunion. Historische Erfahrungen und militärische Lehren 1919–1991*. Baden-Baden: Nomos-Verlag.

Lachmann, Ernest. 1977. Anatomist of infamy: August Hirt. *Bulletin of the History of Medicine* 51: 594–602.

Lang, Hans-Joachim. 2004. *Die Namen der Nummern. Wie es gelang, die 86 Opfer eines NS-Verbrechens zu identifizieren*. Hamburg: Hoffmann und Campe.

Ley, Astrid, and Günter Morsch. 2007. *Medizin und Verbrechen. Das Krankenrevier des KZ Sachsenhausen 1936–1945*. Schriftenreihe der Stiftung Brandenburgische Gedenkstätten 21. Berlin: Metropol-Verlag.

Martinetz, Dieter. 1996. *Vom Giftpfeil zum Chemiewaffenverbot. Zur Geschichte der chemischen Kampfmittel*. Frankfurt am Main: Verlag Harri Deutsch.

Mills, A.K. 1945. *Investigations of Chemical Warfare Installations in the Munsterlager area, including Raubkammer*. CIOS File No. XXXI-86, ed. SHAEF Combined Intelligence Objectives Sub-Committee—G-2 Division, London.

Mitscherlich, Alexander, and Fred Mielke. 1947. *Das Diktat der Menschenverachtung. Eine Dokumentation*. Heidelberg: Verlag Lambert Schneider.

Morsch, Günter, and Bertrand Perz, eds. 2011. *Neue Studien zu nationalsozialistischen Massentötungen durch Giftgas: Historische Bedeutung, technische Entwicklung, revisionistische Leugnung*. Schriftenreihe der Siftung Brandenburgische Gedenkstätten. Berlin: Metropol-Verlag.

Müller, Rolf Dieter. 1985. World power status through the use of poison gas? German preparations for chemical warfare, 1919–1945. In *The German military in the age of total war*, ed. Wilhelm Deist, 171–209. Warwickshire: Berg Publishers.

Neumann, Alexander. 2005. "*Arzttum ist immer Kämpfertum". Die Heeressanitätsinspektion und das Amt "Chef des Wehrmachtssanitätswesens" im Zweiten Weltkrieg*. Düsseldorf: Droste.

Oehler-Klein, Sigrid, and Alexander Neumann. 2004. Die Militarisierung der Medizin an der Universität Gießen und ihre Beziehungen zu den Sanitätsinspektionen von Heer und Luftwaffe im Zweiten Weltkrieg. *Mitteilungen des Oberhessischen Geschichtsvereins Gießen* 89: 95–188.

Oestreich, Gerhard. 1954. *Kürschners deutscher Gelehrten-Kalender 1954*, 8th ed. Berlin: de Gruyter.

Pechura, Constance M., and David P. Rall. 1993. *Veterans at risk: The health effects of mustard gas and lewisite*. Washington, D.C.: National Adademy Press.

Reitzenstein, Julien. 2014. *Himmlers Forscher: Wehrwissenschaft und Medizinverbrechen im "Ahnenerbe" der SS*. Paderborn: Schöningh.

Roelcke, Volker. 2017. The use and abuse of medical research ethics: The German Richtlinien/guidelines for human subject research as an instrument for the protection of research subjects—and of medical science, ca. 1931–1961/64. In *From clinic to concentration camp: Reassessing Nazi medical and racial research, 1933–1945*, ed. Paul Weindling, 33–56. Milton Park: Routledge.

Rundschreiben des Reichsministers des Inneren vom 28.2.1931: Richtlinien für die neuartige Heilbehandlung und für die Vornahme wissenschaftlicher Versuche am Menschen. 1931. *Reichsgesundheitsblatt* 55: 174–175.

Sass, Hans-Martin. 1983. Reichsrundschreiben 1931: Pre-nuremberg German regulations concerning new therapy and human experimentation. *Journal of Medicine and Philosophy* 8 (99): 99–111.

Schleiermacher, Sabine. 1988. Die SS-Stiftung "Ahnenerbe." Menschen als Material für "exakte" Wissenschaft. In *Menschenversuche. Wahnsinn und Wirklichkeit*, ed. Rainer Osnowski, 70–87. Köln: Volksblatt Verlag.

Schmaltz, Florian. 2005. *Kampfstoff-Forschung im Nationalsozialismus. Zur Kooperation von Kaiser-Wilhelm-Instituten, Militär und Industrie*. Geschichte der Kaiser-Wilhelm-Gesellschaft im Nationalsozialismus 11. Göttingen: Wallstein Verlag.

Schmaltz, Florian. 2006a. Otto Bickenbach's human experiments with chemical warfare agents at the concentration camp Natzweiler in the context of the SS-Ahnenerbe and the Reichsforschungsrat. In *Man, medicine and the state. The human body as an object of government sponsored research in the 20th century*, ed. Wolfgang U. Eckart, 139–156. Beiträge zur Geschichte der Deutschen Forschungsgemeinschaft 2. Stuttgart: Steiner.

Schmaltz, Florian. 2006b. Pharmakologische Nervengasforschung an der Militärärztlichen Akademie und an den Universitäten Marburg, Danzig und Leipzig im Zweiten Weltkrieg. In *Medizin im Zweiten Weltkrieg*, ed. Wolfgang U. Eckart, and Alexander Neumann, 171–194. Paderborn: Schöningh.

Schmaltz, Florian. 2009. Chemical weapons research in National Socialism: The collaboration of the Kaiser Wilhelm institutes with the military and industry. In *The Kaiser Wilhelm Society under National Socialism*, ed. Susanne Heim, Carola Sachse, and Mark Walker, 312–338. Cambridge: Cambridge University Press.

Schmidt, Gerald. 1985. Ludwig Lendle (1899–1969). In *Neue Deutsche Biographie*, ed. Historische Kommission bei der Bayrischen Akademie der Wissenschaften, 201–202. Berlin: Duncker & Humblot.

Schmidt, Ulf. 2007. *Karl Brandt: The Nazi doctor. Medicine and power in the Third Reich*. London: Continuum.

Schmidt, Ulf. 2013. Accidents and experiments: Nazi chemical warfare research and medical ethics during the Second World War. In *Military medical ethics for the 21st century*, ed. Michael L. Gross, and Don Carrick, 225–244. Farnham, Surrey: Ashgate.

Schuder, Werner. 1961. *Kürschners deutscher Gelehrten-Kalender 1961. A-N*, 9th ed. Berlin: de Gruyter.

Schuder, Werner. 1970. *Kürschners Deutscher Gelehrten-Kalender 1970*. Berlin: Walter de Gruyter.

Schultz, Gebhard. 2001. Militärisches Sperrgebiet. Die Zitadelle Spandau im Nationalsozialismus. *Berlinerische Monatsschrift* 7: 51–59.

Spiegelberg, Ulrich, Karl Dierkes, and Hans Bürger-Prinz. 1961. *Psychopathologisch-neurologische Schäden nach Einwirkung synthetischer Gifte*. Wehrdienst und Gesundheit: Abhandlungen aus Wehrmedizin, Wehrpharmazie und Wehrveterinärwesen. Darmstadt: Wehr und Wissen Verlagsgesellschaft.

Steegmann, Robert. 2005. *Struthof. Le KL-Natzweiler et ses kommandos: une nébuleuse concentrationnaire des deux côtés du Rhin, 1941–1945*. Strasbourg: Nuée bleue.

Steegmann, Robert. 2010. *Das KZ Natzweiler-Struthof und seine Außenkommandos an Rhein und Neckar 1941–1945*. Berlin: Metropol.

Szöllösi-Janze, Margit. 1994. Von der Mehlmotte zum Holocaust. Fritz Haber und die chemische Schädlingsbekämpfung während und nach dem Ersten Weltkrieg. In *Von der Arbeiterbewegung zum modernen Sozialstaat. Festschrift für Gerhard A. Ritter zum 65. Geburtstag*, ed. Jürgen Kocka, 658–682. München: Saur.

Trunk, Achim. 2011. Die todbringenden Gase. In *Neue Studien zu nationalsozialistischen Massentötungen durch Giftgas. Historische Bedeutung, technische Entwicklung, revisionistische Leugnung*, eds. Günter Morsch, and Bertrand Perz, 23–49. Berlin: Metropol Verlag.

Uhlmann, Angelika. 2011. August Hirt und seine Mitarbeiter Kiesselbach, Wimmer und Mayer. Die Karrieren vor der Reichsuniversität Straßburg. *Revue d'Allemagne et des Pays de Langue Allemande* 43(3): 333–340.

Uhlmann, Angelika, and Andreas Winkelmann. 2015. The science prior to the crime. August Hirt's career before 1941. *Annals of Anatomy* 204: 118–126.

Wirth, Wolfgang. 1936. Über die Wirkung kleinster Phosgenmengen. *Naunyn-Schmiedebergs Archiv für Pathologie und experimentelle Pharmakologie* 181: 198–206.

Witkowski, Józef, and Aleksandra Rudy. 1987. Gaz bojowy tabun a podobóz Dyhernfurth. *Przegląd Lekarski* 34 (1): 131–142.

Woelk, Wolfgang. 2003. Der Pharmakologe und Toxikologe Wolfgang Wirth (1898–1996) und die Giftgasforschung im Nationalsozialismus. In *Nach der Diktatur. Die Medizinische Akademie Düsseldorf nach 1945*, eds. Wolfgang Woelk, Frank Sparing, Karen Bayer, and Michael G. Esch, 269–287. Essen: Klartext-Verlag.

Wojak, Irmtrud. 1999. Das "irrende Gewissen" der NS-Verbrecher und die deutsche Rechtssprechung. Die "jüdische Skelettsammlung" am Anatomischen Institut der "Reichsuniversität Straßburg." In *"Beseitigung des jüdischen Einflusses…" Antisemitische Forschung, Eliten und Karrieren im Nationalsozialismus*, ed. Fritz-Bauer-Institut, 101–130. Jahrbuch 1998/99 zur Geschichte und Wirkung des Holocaust. Frankfurt, New York: Campus Verlag.

No Retaliation in Kind: Japanese Chemical Warfare Policy in World War II

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Abstract This essay examines Japan's Chemical Warfare (CW) policy in World War II as revealed in interrogations of high-ranking military officers conducted by United States military intelligence after the war. Based upon these interrogations and an examination of recorded incidents of chemical weapons use, it may be concluded that Japanese CW policy permitted use of chemical weapons in China where the enemy did not possess the capacity to retaliate in kind, but largely prohibited their use in the Pacific against the Allies, whom they feared could respond in kind with overwhelming force. Thus, the threat of retaliation in kind served as a successful deterrent to CW employment in the Pacific Theater. For its part, the US refrained from using poison gas largely due to President Franklin D. Roosevelt's moral abhorrence of chemical weapons, but also because it was not in a position logistically to engage in CW on a large scale until late in the conflict, at which time the use of nuclear weapons made the issue moot.

From 1937 to 1945, the military services of Japan used chemical weapons on over 2000 occasions, primarily in the China Theater of Operations. In contrast, there were only a few occasions of use against Allied forces in the Pacific. The primary reason for this great disparity in incidents of use was Japan's fear of retaliation in kind. While engaged in combat against military forces in China, the Imperial Japanese Army used a variety of chemical weapons without concern of retaliation in kind by the technologically inferior Chinese military, which was utterly lacking in chemical weapons and whose soldiers often lacked even basic protective gear such as gas masks. In China, Japanese military forces often found themselves at a numerical disadvantage and used chemical warfare (CW) as a means to compensate. In most instances, the Japanese used tear gas and smoke candles, but there are numerous recorded incidents of more debilitating and lethal gases also being deployed. Combat in the Pacific Theater, however, was a different matter. Japanese military forces tended to use CW while on the offensive in open terrain, such as in

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B. Friedrich et al. (eds.), *One Hundred Years of Chemical Warfare: Research, Deployment, Consequences*, DOI 10.1007/978-3-319-51664-6_14

China; but, when on the defensive in more restrictive environments, such as in close combat on the various Pacific islands against Allied forces, CW was not a viable option. More important was the fact that in the Pacific the Japanese were primarily up against the armed forces of the United States, which not only had the ability to respond in kind, but—it was thought—were backed by a national industrial capacity that could utterly annihilate Japan with chemical weapons should the Japanese initiate this type of warfare.

This essay examines Japan's CW policy in China and the Pacific Theater during World War II and argues that the perceived ability of the enemy to retaliate in kind was the primary factor in determining the use of chemical weapons by the Japanese. Legal prohibitions against using poison gases, such as those set forth in the Geneva Protocol of 1925, which Japan did not ratify in any case, were a secondary consideration (Robinson 1971, 289). Moreover, there was a significant disconnect between the stated official policy governing the use of chemical weapons and their actual employment upon the battlefield. Interrogations of high-ranking army officers, such as General Tojo Hideki,[1] conducted by US military intelligence after the war revealed that responsibility for approving use of lethal chemical weapons remained intentionally hazy, even though the actual chain of command was clear. This ambiguity in policy implementation served the interests of the top brass, who, after the war, attempted to avoid prosecution by exploiting the opacity of Japan's CW policy in China and the Pacific.

In Japan, military interest in chemical weapons originated with reports of the use of poison gas at Ypres on April 22, 1915. The Army Technology Review Board, which was responsible for monitoring innovations in weaponry, began to investigate the potential of developing an array of chemical weapons, poison gas launchers, and gas masks. One of the first Japanese scientists to pursue an interest in chemical weapons was Koizumi Chikahiko, a physician assigned to the School of Hygiene at the Army Medical College (*Rikugun Gun'i Gakkō*) who specialized in the study of industrial toxins. By the end of 1915, Koizumi emerged as the lead researcher in CW for the army and ultimately earned the moniker of "father of chemical warfare in Japan." In September 1917, the Army Medical College constructed a new Chemical Weapons Laboratory to support his research, and in the following year, Koizumi was named the laboratory's "Chief of Research on Protective Devices." He would go on to develop one of the first gas masks to be adopted for general use by the army (Tsuneishi 1984, 100–103; Tsuneishi and Asano 1982, 51–56). Research and development of chemical weapons was not given a high priority at this time, however, as Japan was not a principal belligerent in the war and lacked the relative urgency of the other participants. As a result, Japan's foray into chemical weapons developed more slowly than in Europe and the United States (Grunden 2005, 165–196; Murata et al. 1996, 16–31; Robinson 1971, 287–289).

[1]Japanese names appear here with family name first and given name second, as is the custom in Japan.

Japan's CW program grew sporadically throughout the 1920s and 1930s. In April 1919, the Army Institute of Scientific Research (*Rikugun Kagaku Kenkyūjo*) was established as the central R&D facility of the Army Technical Headquarters (*Rikugun Gijutsu Honbu*), at which time it assumed jurisdiction over the army's CW program. In 1923, disaster struck. The Great Kantō Earthquake devastated much of Tokyo and leveled several buildings housing the army's R&D facilities for its CW program, including some on the campus of the Army Medical College and some belonging to the Army Institute of Scientific Research. The army exploited the disaster as an opportunity to upgrade its program, allocating a sum of ¥1.2 million for the construction of new laboratories. The Imperial Japanese Navy followed by initiating its own CW program that year at the Navy Technical Research Institute (Tsuneishi 1984, 102–105; Tanaka 1988, 11).[2] In the war that was to come, three military institutions would account for nearly all of the CW research being conducted in Japan: the Sixth Army Technical Institute under the Army Institute of Scientific Research, the Imperial Japanese Army Air Service's Third Laboratory, and the Imperial Japanese Navy's Sagami Naval Research Department (Robinson 1971, 287–289).[3]

In 1927, the army appropriated the island of Okunoshima and established its central chemical weapons production facility there. Located in the Inland Sea in Hiroshima prefecture, this small island, only four kilometers in circumference, provided secrecy and a measure of safety, being removed some three kilometers from the nearest city of Tadanoumi. In May 1929, the Okunoshima facility began production of tear and mustard gases, but would later produce an array of other lethal gases as well (Tanaka 1988, 12–14). At its peak capacity, Okunoshima produced some 200 tons of mustard gas (H), 50 tons of lewisite (L), 80 tons of diphenylcyanoarsine (DC), 50 tons of hydrocyanic (Prussic) acid (HCN), and 2.5 tons of chloroacetophenone (CN) per month.[4]

A Chemical Warfare School was established at Narashino, Chiba prefecture, in 1933, under the auspices of the Inspector General of Military Education, and served as the principal training facility for both the Imperial Japanese Army and Navy. According to a US military intelligence report, Narashino was "splendidly equipped, well staffed, and effective in the fulfillment of its mission until the end of the

[2]On the navy CW program, see General Headquarters, United States Army Forces, Pacific, Scientific and Technical Advisory Section, "Report on Scientific Intelligence Survey in Japan: September and October 1945," November 1, 1945, vol. IV, Chemical Warfare, RG 457, Entry 9032, Box 765, US National Archives, College Park Md., pp. 19, 22, and appendices CW-3-1, CW-4-1, and CW-8-5. [Hereafter cited as GHQ, "Report on Scientific Intelligence Survey."].

[3]Ibid., pp. 3, 39, 46–47, appendix CW-3-1.

[4]Ibid., p. 42, appendix CW-2-2, CW-6-1, and CW-6-2.

war," and graduated 3074 officers between 1939 and 1945.[5] The training of Japanese soldiers in defense against gas warfare was well organized and well executed, and all Japanese troops and a large number of reservists received CW training.[6] One overall significant shortcoming of Japan's CW program, however, was that no separate, independent chemical warfare division with oversight of all CW activities in the military services was ever established, which ultimately resulted in a "failure to develop an integrated, balanced and coordinated program."[7] As a result, the Japanese military forces never achieved more than "a limited tactical capability" with chemical weapons (Robinson 1971, 289).

As "the curtain opened" on the war in China with the Marco Polo Bridge Incident on July 7, 1937, so began Japan's foray into chemical warfare (Murata et al. 1996, 10). The Japanese army began to use "gas" weapons against the Chinese almost immediately, with the first incident reported as early as July 18, 1937.[8] Reports of Japanese use of smoke, tear gas, and poison gas steadily increased as the conflict in China dragged on and the war situation worsened (Yoshimi 2004, 49–68; Wakabayashi 1994, 3–8). Reports received through "official sources" stated there was "no proof that lethal or toxic chemicals were used prior to the fall of 1939." However, "lethal gases definitely appeared in the summer of 1941," though their use was "confined to restricted areas where the Chinese were exerting pressure," and they were used in such cases "generally to support Japanese counter-attacks."[9] In the "Ichang Incident," for example, a three-day battle that began on October 8, 1941, Japanese forces barraged the Chinese with gas shells for over four hours and dropped more than 300 gas-laden bombs on Chinese positions. An investigation conducted by a US Chemical Warfare Service (CWS) officer assigned to General Joseph Stillwell in the China-Burma-India Theater confirmed that mustard and CN gases had been used and that there was evidence suggesting lewisite may have been deployed as well. In this incident, there were 1600 confirmed casualties, 600 of which were killed in action as the result of Japan's use of poison gases.[10] During the war in China, Imperial Japanese Army forces are alleged to have used chemical

[5]Office of the Chief Chemical Officer, GHQ, AFPAC, Tokyo, Japan, "Intelligence Report on Japanese Chemical Warfare," vol. I, "General Organization, Policies and Intentions, Tactics," May 15, 1946, RG 319, Entry 82, Box 2097, File: "Japanese Chemical Warfare Policies and Intentions —US Army Forces, Pacific," US National Archives, College Park, Md., p. 19. [Hereafter cited as Chief Chemical Officer, "Intelligence Report on Japanese Chemical Warfare."].

[6]United States Military Intelligence Service, *Enemy Capabilities for Chemical Warfare*. Washington, DC: US War Department, 1943, 87–88.

[7]Chief Chemical Officer, "Intelligence Report on Japanese Chemical Warfare," p. 21.

[8]Ibid., p. 8.

[9]"Condensed Statement of Information Available Concerning Japanese Use of War Gas," RG 319, Publications File, Entry 82, Box 2098, US National Archives, College Park, Md., p. 1. [Hereafter cited as "Condensed Statement."].

[10]Ibid., pp. 1–2.

weapons on as many as 2091 separate occasions, with estimates of casualties ranging from 36,968 to 80,000, including both military personnel and civilians.[11]

In the aftermath of World War II, the United States Army Chief of Staff, together with Army Intelligence (G-2) and officers of the CWS, conducted a thorough investigation of Japanese activities in chemical warfare to assess Japan's capacity to wage large-scale war using chemical weapons and "to ascertain whether the Japanese possessed knowledge, techniques, materiel, or procedures superior to our own and worthy of adoption."[12] Because of the general order to destroy evidence upon Japan's surrender on August 15, 1945, documentation for the investigators was lacking (Drea et al. 2006, 9–11). As a result, interrogations of high-ranking military personnel served as one of the most important sources of information and played a key role in the investigation. Through the interrogations, US intelligence personnel attempted to discern what constituted chemical warfare policy within the Imperial Japanese Army and who was responsible for its implementation.

Among the first to be questioned was General Tojo Hideki, who had served as Vice-Minister of War from July to December 1938, and then as Minister of War from July 1940 to July 1944. He served concurrently as Prime Minister from October 17, 1941 to July 22, 1944. As such, he was in a position not only to have influenced the formation of CW policy, but to have overseen its implementation as well. Interrogated on April 2, 1946, just a few weeks before the International Military Tribunal for the Far East, or "Tokyo Trials," were to begin, Tojo was understandably very cagey with his answers. He admitted CW *research* was conducted in Japan, but emphasized that it was done only in a "defensive sense" and that "precautions" were taken "in the same spirit."[13] He was adamant that the use of chemical weapons was forbidden because, had they been used, "it would have been disastrous for Japan." On this point, he articulated three specific reasons why he personally opposed the use of chemical weapons. First, it was against international law, which, he stated, "Japan had to follow." Secondly, he cited the industrial superiority of the United States. Finally, he stated that Japan is "an island country and if it were used, it would be very unfortunate for her." For these reasons, he stated, "I made a tremendous fuss about this and absolutely forbade its use, so I

[11]The figures given for incidents of poison gas attacks range from 886 to 2091 separate occasions. See "Condensed Statement", p. 1; Awaya (1992, 3–6). Documentation of such numbers remains problematic even after the release of numerous seminal documents concerning Japanese CW in China. See Awaya and Yoshimi (1989), Drea et al. (2006).

[12]Chief Chemical Officer, "Intelligence Report on Japanese Chemical Warfare," p. 1.

[13]Geoffrey Marshall, Colonel, CWS, Chief Chemical Officer, General Headquarters, United States Army Forces, Pacific, Office of the Chief Chemical Officer, "Japanese Chemical Warfare Policies and Intentions," April 13, 1946, "Interrogation of General Hideki Tojo," conducted April 2, 1946, RG 319, Entry 85A, MIS#: 261223, US National Archives, College Park, Md., p. 1. [Hereafter cited as Marshall Interrogations.].

prohibited it, both from the standpoint of policy and strategy." He added, "as War Minister, I had enough voice in this sphere to see that it was not used as a military policy."[14]

When asked about specific orders being issued to field commanders concerning chemical weapons at the beginning of the war, he flatly stated, "During the time of the China Incident, it was forbidden and gas could not be used without my consent." But his chief interrogator, Lieutenant Colonel John E. Beebe, Jr. of the US Chemical Warfare Service, persisted, knowing that chemical weapons had been used on numerous occasions in the China Theater. Tojo began to prevaricate and attempted to make a distinction between simple "harassing agents" such as smoke and tear gas and "casualty agents" such as poison gases that could be debilitating or fatal. Tojo argued that "casualty agents" were "absolutely forbidden," but that harassing agents—those that result in coughing, sneezing, and tear production—were "used to a certain extent." Tojo was adamant that he refused requests from the Supreme Commander in the China Theater to use casualty agents, though he did approve use of harassing agents.[15]

Beebe now had Tojo in a corner. He asked, "You mentioned earlier that Japan was obligated by international law and treaties not to use gas warfare. How, then, can you explain the use of harassing agents against the Chinese?" Tojo replied, "The police all over the world use tear gas and sneezing gas. They are used even in your country." Beebe followed, "Was not the use of these harassing agents also prohibited by international law?" Tojo flatly stated, "In fact, they were in use by the police throughout the world. How about the atom bomb?"[16] In this exchange, Beebe established that Japan did not adhere to any strict interpretation of international law concerning the use of chemical weapons and that Tojo himself had approved their use in the China Theater, though Tojo was adamant that he had approved only the use of harassing agents.

Next, Beebe interrogated General Kawabe Masakazu, who had an extensive service record in the China Theater. Kawabe was a Major-General and had served as a commander in the Permanent China Brigade during the Marco Polo Bridge Incident in July 1937. From August 1937, he served as the Deputy Chief of Staff of the North China Army; from February 1938 to January 1939, he served as the Chief of Staff of the Central China Expeditionary Army.[17] With this service record, Kawabe was certainly in a position to know of Japanese employment of CW in China. In a previous interrogation, conducted one month prior, Kawabe had

[14]Ibid., pp. 1–2.

[15]Ibid., pp. 2, 4–5.

[16]Ibid., p. 6.

[17]In January 1939, Kawabe returned to Japan to assume the post of Deputy Inspector-General of Military Education, then became Inspector-General himself in September. After serving a short stint as the C-in-C of the IJA 3rd Army, in August 1942 he was promoted to Chief of Staff of the China Expeditionary Army, in which post he served until March 1943. See: Kawabe Masakazu (1886–1965). *The Pacific War Online Encyclopedia*. http://pwencycl.kgbudge.com/K/a/Kawabe_Masakazu.htm. Accessed April 11, 2015.

disavowed any knowledge of chemical weapons having been used in China, nor would he subsequently admit to having requested approval for their use. But now, Kawabe made exceptions for "special smoke," which in this cased referred to a smoke candle the Japanese called *aka-to* ("red candle"), which was actually diphenylcyanarsine (DC), a sneezing gas frequently used by Japanese forces in China. Beebe questioned Kawabe concerning various battles in which such "special smoke" had been deployed, including one occasion where some six or seven thousand special smoke candles had been used. When pressed for information on these incidents, Kawabe consistently replied, "I do not remember," a refrain he repeated often.[18]

Beebe then questioned Kawabe about a document that bore his name, entitled, "Lessons from the China Incident," which was published by the Inspectorate General of Military Education, Chemical Warfare Section, on April 15, 1939.[19] Beebe confronted Kawabe with a copy of "Lessons" and pointed to the entry for chapter six, entitled, "The Chinese Army as Seen from the Point of View of Chemical Warfare." This chapter enumerated the many deficiencies of the Chinese military forces in defending against chemical weapons, including evaluations of the poor quality of Chinese gas masks, the fact that they were not issued to all Chinese soldiers, and the observation that those who did have them often lacked proper training in their use. One entry in this chapter noted that some Chinese soldiers had "died by asphyxiation, sticking their noses and mouths into the ground" to avoid breathing the smoke.[20]

When confronted with such damning evidence of Japan's CW in China, Kawabe again disavowed any knowledge of poison gases and stated these must have been instances of use of "special smoke," which he insisted was a non-toxic gas. Beebe pressed Kawabe further about policy concerning the use of more lethal gases, including mustard, lewisite, and phosgene. To this, Kawabe replied, "The use of these gases was not thought about. No one had it. It was forbidden." Kawabe then attempted to differentiate "special smoke" from poison gases, but claimed that this was his "private opinion" and that he could not speak for the army. Beebe followed, "What about international law and treaties on the use of gas?" Kawabe answered, "In my opinion treaties did not cover special smoke."[21] Thus, in such a manner, the top brass of the Imperial Japanese Army parsed the language of international law that prohibited chemical weapons and rationalized the use of "special smoke" as a non-lethal gas.

[18]Marshall Interrogations, "Continued Interrogation of General Masakazu Kawabe," April 10, 1946, pp. 1–4.

[19]Ibid., pp. 1, 6–8. A copy of "Lessons" may be found in Chief Chemical Officer, "Intelligence Report on Japanese Chemical Warfare," pp. 87–124.

[20]Marshall Interrogations, "Continued Interrogation of General Masakazu Kawabe," pp. 6–7.

[21]Ibid., pp. 8–9.

Beebe encountered this rhetoric yet again when interrogating General Hata Shunroku. Like Kawabe, Hata also began his long and infamous career in the China Theater. Hata assumed command of the Central China Expeditionary Forces in February 1938 and held that post until December, when he became a member of the Supreme War Council. In September 1939, Hata was appointed Minister of War and served under two successive prime ministers until being replaced by Tojo in July 1940. In 1941, Hata was appointed Commander-in-Chief of all armies in the China Theater, including the North, Central, and South China Armies.[22] Clearly, Hata should have been quite well-informed about CW policy in China. In his interrogation of Hata, conducted on April 11, 1946, Beebe had him articulate a clear chain of command from the Cabinet level on down through the top ranks of the army. Then, Beebe sought to identify the level at which the employment of "gas warfare" could be authorized. Hata was firm in his assertion that approval for use of poison gas could only come from the Imperial General Headquarters, and that it was expressly forbidden while he served as commander of the Central China Expeditionary Force in 1938. Beebe next asked Hata *when* he received permission to employ gas weapons. Hata replied, "In each case we were authorized by Imperial General Headquarters. There was no blanket authority." Beebe followed with "When did you first receive authority to employ gas?" Surprisingly, Beebe then started to get from Hata the sort of information he was seeking.

Although it is difficult to determine tone from a transcript, Hata's answer appears rather matter-of-fact. He stated, "Tear gas could be used at any time. No specific permission was necessary. Sneezing gas (*aka-to*) could also be used at any time."[23] He also admitted that they had achieved "very good results" using tear and sneezing gases and experienced few to no casualties when these were deployed in combat against the Chinese, most of whom did not have gas masks and would "break and run" or flee in disorder "the minute sneezing gas was used." When pressed to make a distinction between these agents and poison gas, Hata stated, "Poison gas is one which kills or has a permanent disabling effect. I think mustard, lewisite and phosgene are poison gases, but tear and sneezing gases are not. Where avoidable, we did not use tear and sneezing gas, nor did we use it recklessly. Only where we expected great loss to ourselves or the enemy did we use it."[24]

Hata had revealed perhaps more than he intended, for he had actually confirmed for Beebe that, in fact, no special authorization was needed to use such gases, that they could be used "at any time," and that they were a common weapon frequently used by Japanese soldiers in China. Indeed, when asked if he had ever ordered his

[22]His authority did not extend to the Kwantung Army in Manchuria, which remained under a separate command. Marshall Interrogations, "Interrogation of General Shunroku Hata," April 11, 1946, pp. 1–2. See also: Hata Shunroku (1879–1962). *The Pacific War Online Encyclopedia*. http://pwencycl.kgbudge.com/H/a/Hata_Shunroku.htm. Accessed April 11, 2015.

[23]Marshall Interrogations, "Interrogation of General Shunroku Hata," p. 3.

[24]Ibid., p. 5.

troops to discontinue using these gases in China, Hata replied, "No. They could use sneezing gas without stopping. That was the policy of Imperial General Headquarters."[25] Hata may have been truthful on this point, but on so many others, Tojo, Kawabe, and Hata were obviously lying. Japanese forces in China clearly had used gases other than the tear and sneezing varieties. Of 65 incidents of CW reported in a document dated October 6, 1944, the vast majority indicated use of vomit-inducing gases, blistering agents, and in one instance, the possible use of a nerve toxin.[26] In any case, it was now clear that CW policy in the China Theater permitted the widespread and common use of harassing agents such as tear and sneezing gases, and that other, more lethal types of poison gases were also used, although on a more limited basis.

From 1942 through 1943, Japan's use of poison gases such as vomiting and blistering agents as well as mustard gas and lewisite actually increased on the China front.[27] Although US President Franklin D. Roosevelt had denounced Japan's employment of CW in China as early as 1938, there was little he could do to stop it. With the US now in the war, however, and with more incidents of poison gas use being reported, Roosevelt attempted to take a more aggressive stand. On June 5, 1942, he publicly stated, "I desire to make it unmistakedly [sic] clear that if Japan persists in this inhuman form of warfare against China or against any other of the United Nations, such action will be regarded by this Government as though taken against the United States and retaliation in kind and in full measure will be meted out" (Rosenman 1950, 258). Any such threats to retaliate in kind at that time, however, were largely hollow and not likely to be realized as the US did not then possess sufficient quantities of chemical weapons in the Pacific to respond on a large scale (Spiers 1986, 73–75; Moon 1984, 12–14). But it was important, perhaps, for the US to clearly articulate its own CW policy in order to attempt to deter further Japanese use of chemical weapons in China.

As the Allies began to advance further across the Pacific, Japanese military forces' use of chemical weapons diminished significantly. In the Pacific Theater, chemical weapons were to be used only on the defensive and *only if* the Allies used them first. This policy was strictly observed with very few exceptions. For example, during the Battle of Guadalcanal, which typified the intensity of combat that was all too common in the jungles of the Southwestern Pacific, on two occasions, January 23 and 28, 1943, Japanese soldiers resorted to using toxic smoke against US troops. Such incidents could be looked upon as the actions of a few desperate men and

[25]Ibid., pp. 5–9.

[26]"Reports of Incidents of Use of Gas by Japanese," October 6, 1944, RG 319, Publications File, Entry 82, Box 2098, US National Archives, College Park, Md., pp. 1–5.

[27]Ibid.

were not likely pre-planned.[28] Nonetheless, in April 1943, President Roosevelt issued yet another stern warning stating that if any of the Axis Powers used gas against any of the Allies, the US would "retaliate with overwhelming force." But Roosevelt also made clear that the US would not be the first to initiate chemical warfare.[29]

Roosevelt's warnings and his articulation of US CW policy appear to have had an impact. Tojo acknowledged as much during his interrogation, stating, "I thought, as I had from the beginning, that the use of gas would be very disadvantageous for Japan because of America's tremendous industrial capacity and this statement of the President strengthened my own ideas."[30] This response was echoed by Major General Akiyama Kinsei, who served as the director of the army's CW training school at Narashino from 1935 to 1940. During his interrogation, Akiyama confirmed that Roosevelt's threat of massive retaliation likely prevented the spread of CW attacks throughout the Pacific.[31] Roosevelt's declaration may also have led to a wider de-escalation of CW in China, as well as the actual termination of large-scale industrial production of poison gases in Japan.[32] As the war in Europe turned decisively against Germany following the D-Day invasion in June 1944, Japan's military leaders began to worry that Germany might resort to using chemical weapons to stop the Allied advance on Berlin. In the summer of 1944, the Japanese army ordered the recall of all stocks of gas munitions in the field to depots in rear echelon positions. This order was given as a precaution "against irresponsible use by isolated units in desperate situations which might provoke full scale retaliation."[33] Not only were the Japanese concerned that the US would retaliate against Japan if Germany initiated CW in Europe, they now sought to minimize the possibility that any chemical weapons would be used by their own forces in the Pacific Theater.[34]

The Japanese apparently trusted Roosevelt's pledge not to initiate a first strike, but they also took precautions not to precipitate one by the US late in the war. Theoretically, at that point, the US could have hit Japan with a CW attack without

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[28]The report indicates it was a "choking gas," but does not elaborate on the means of dissemination, whether by smoke candle, grenade, mortar, or otherwise. See "Reports of Incidents of Use of Gas by Japanese," October 6, 1944, RG 319, Publications File, Entry 82, Box 2098, US National Archives, College Park, Md., p. 3; "Condensed Statement," p. 1.

[29]Marshall Interrogations, "Interrogation of General Hideki Tojo," p. 4.

[30]Ibid.

[31]Major H. Skipper, interview with Major General K. Akiyama, October 16, 1945, in GHQ, "Report on Scientific Intelligence Survey," appendix CW-13-3.

[32]In September 1944, the army's primary facility for chemical weapons production at Okunoshima was converted to the manufacture of conventional explosives. See Target No. 635, "Manufacture of Poison Gases," RG 319, Entry 85A, MIS#: 235950-1, US National Archives, College Park, Md., p. 1.

[33]Chief Chemical Officer, "Intelligence Report on Japanese Chemical Warfare," pp. 7–8.

[34]According to the report of the Chief Chemical Officer, "The Japanese were even prepared to overlook small scale local tactical use by the Allies to avoid general gas warfare [… although] Retaliation would have been attempted in the event of large-scale attacks." Ibid., pp. 7–8.

violating the Geneva Protocols' prohibitions against first use. Allied CW policy, as stated in the Combined Chiefs of Staff document 106/2, and as clearly articulated in numerous declarations by Roosevelt and Prime Minister Winston Churchill, considered an attack on any United Nations ally to be an attack on the US or Great Britain. Thus, because Japan had already initiated CW attacks upon China, the US would have been justified in retaliating in kind (Moon 1984, 12–13, 1996, 501). But it did not. Historian John Ellis van Courtland Moon provides several reasons for US restraint. First and foremost was the "widespread moral revulsion against chemical weapons" engendered by their use in the First World War. Secondly, Allied CW policy was limited to deterrence and retaliation. Third, chemical weapons "offered limited military advantages and carried serious liabilities." Finally, Moon argues, the US was "unprepared throughout the war to wage chemical warfare in the Pacific Theater." In short, "preparations always lagged behind policy" (Moon 1989a, 40–42; b, 317).

Although deploying chemical weapons on a large scale presented certain logistical difficulties in the Pacific Theater, they were not insurmountable. Military and government leaders in the US began to call for their use as early as the summer of 1943. The "Island Hopping" campaign in the Pacific had resulted in the accumulation of excessive casualties, particularly among the US Marines, to whom the duty of being first to land and establish beachheads usually fell. Following the battle of "Bloody Tarawa" in November 1943, the Chief of the US Chemical Warfare Service, General William N. Porter, argued for the employment of poison gas against the remaining Japanese forces in the Pacific. He argued, "the tactical advantages of using gas against entrenched enemy positions were undeniable." Moreover, they were justified, as the Japanese had already used poison gas in the China Theater. But his request was denied. At that time, Roosevelt and the Chiefs of Staff were concerned that such use would proliferate to Europe and provide Hitler a rationale for using chemical weapons against Allied forces in any attempted cross-channel invasion. At least while Germany remained in the war, the Allies could not risk any proliferation. (Moon 1984, 17) Yet, even after the defeat of Germany, when US Army Chief of Staff General George C. Marshall proposed CW use in a pending invasion of the home islands of Japan, his request was denied on "moral and policy grounds" (Moon 1989a, 42). Once Germany was defeated, numerous "liabilities" of CW use disappeared, but the tactical advantages remained.

Others argued that the military advantages of using CW against Japan in the Pacific far outweighed any liabilities once Germany was out of the war. Experiments with mustard gas in late 1943 suggested it would be a highly effective weapon in the Pacific, especially in tropical jungles with high humidity. Experiments conducted at the Dugway Proving Ground in Utah suggested that various gas weapons—in combination with more conventional weapons—might be effective in attacking defensive positions in caves, which could be critical should the Allies have to fight all the way to Japan and invade the home islands proper. But another study undertaken jointly by a team of Americans and Canadians in July 1944 concluded, "comparisons of CW requirements with actual HE [high explosive] expenditures in specific operations do not add materially to the picture"

(Freeman 1991, 32–37; Moon 1989b). The stigma attached to CW was a significant factor in delaying its initiation in the Pacific, although the US continued to stockpile a variety of chemical weapons in the summer of 1945 in preparation for the pending invasion of Japan. (Allen and Polmar 1997; Moon 1989b) Ultimately, however, the US did not employ CW in the Pacific Theater. That decision was obviated by the use of an even more devastating weapon—the atomic bomb.

References

Allen, Thomas B., and Norman Polmar. 1997. Gassing Japan. *MHQ: The Quarterly Journal of Military History* 10(1): 38–43.

Awaya, Kentarō. 1992. Japanese mustard gas in China: Then and now. *Sino-Japanese Studies* 4: 3–6.

Awaya Kentarō, and Yoshimi Yoshiaki, eds. 1989. *Jyūgonen sensō gokuhi shiryōshū 18: Dokugasu sen kankei shiryō* [Collection of Top-Secret Documents on the Fifteen-Year War: Documents Concerning Poison Gas Warfare, vol. 18]. Tokyo: Fuji Shuppan.

Drea, Edward, et al. 2006. *Researching Japanese war crimes records: Introductory essays*. Washington, D.C.: Nazi War Crimes and Japanese Imperial Government Records Interagency Working Group.

Freeman, Karen. 1991. The unfought chemical war. *The Bulletin of the Atomic Scientists* 47 (10): 30–39.

Grunden, Walter E. 2005. *Secret weapons & World War II: Japan in the shadow of Big Science*. Lawrence: University Press of Kansas.

Hata Shunroku (1879–1962). 2012. *The Pacific War online encyclopedia*. http://pwencycl.kgbudge.com/H/a/Hata_Shunroku.htm. Accessed 20 Oct 2016.

Kawabe Masakazu (1886–1965). 2012. *The Pacific War online encyclopedia*. http://pwencycl.kgbudge.com/K/a/Kawabe_Masakazu.htm. Accessed 20 Oct 2016.

Moon, John Ellis van Courtland. 1984. Chemical weapons and deterrence: The World War II experience. *International Security* 8(4): 3–35.

Moon, John Ellis van Courtland. 1989a. Chemical warfare: A forgotten lesson. *Bulletin of the Atomic Scientists* 45(6): 40–43.

Moon, John Ellis van Courtland. 1989b. Project SPHINX: The question of the use of gas in the planned invasion of Japan. *The Journal of Strategic Studies* 12(3): 303–323.

Moon, John Ellis van Courtland. 1996. United States chemical warfare policy in World War II: A captive of coalition policy? *The Journal of Military History* 60(3): 495–511.

Murata, Tadayoshi, et al. 1996. *Nihongun no Kagakusen [Chemical Warfare of the Japanese Army]*. Tokyo: Otsuki Shoten.

Robinson, Julian Perry. 1971. *The Rise of CB Weapons: The Problem of Chemical and Biological Warfare: A Study of the Historical, Technical, Military, Legal, and Political Aspects of CBW, and Possible Disarmament Measures*, vol. 1. Atlantic Highlands: Stockholm International Institute for Peace and Conflict Research.

Rosenman, Samuel I. (ed.). 1950. *The public papers and addresses of Franklin D. Roosevelt, 1942: Humanity on the defensive*. New York: Harper and Brothers.

Spiers, Edward M. 1986. *Chemical warfare*. Urbana, IL: University of Illinois Press.

Tanaka, Yuki. 1988. Poison gas: The story Japan would like to forget. *Bulletin of the Atomic Scientists* 44 (8): 10–19.

Tsuneishi, Keiichi, and Asano Tomizō. 1982. *Saikin-sen butai to jiketsu shita futari no igakusha [The Bacteriological warfare unit and the suicide of two physicians]*. Tokyo: Shinchōsha.

Tsuneishi, Keiichi. 1984. C. Koizumi: As a promoter of the ministry of health and welfare and an originator of the BCW research program. *Historia Scientiarum* 26: 95–113.
Wakabayashi, Bob Tadashi. 1994. Documents on Japanese poison gas warfare in China. *Sino-Japanese Studies* 7: 3–33.
Yoshimi Yoshiaki. 2004. *Doku gasusen to Nihongun [Poison gas warfare and the Japanese army]*. Tokyo: Iwanami Shoten.

The 1925 Geneva Protocol: China's CBW Charges Against Japan at the Tokyo War Crimes Tribunal

Jeanne Guillemin

Abstract The 1925 Geneva Protocol, which bans the wartime use of chemical and also biological weapons, was an emphatic reaction to the use of chemical weapons in World War I, but legal institutions that would sanction violations of the treaty have evolved only with difficulty. An important example of a legal failure to support the protocol occurred at the 1946–1948 International Military Tribunal for the Far East (IMTFE), just when it might be expected that Imperial Japan would be charged for its chemical and biological warfare (CBW) waged against China from the late 1930s into World War II. In 1937, the Chinese officially presented its first complaints to the League of Nations about Japan's battlefield use of chemical weapons (mustard gas, phosgene and tear gases) against defenseless Chinese troops and civilians. In addition, in early 1941 and after, China accused Japan of launching plague attacks against key Chinese cities, killing hundreds and terrorizing thousands. None of these accusations, although supported by evidence, brought about serious international recriminations for Japan. Once World War II ended, China expected to revive these charges at the IMTFE in Tokyo. Instead, under the influence of a few key figures in US military intelligence, the trial's International Prosecution Section (IPS) deleted the Chinese charges and for decades Japan's infraction were lost to history. Analysis of this legal failure points to the obstacles posed by growing Cold War antagonisms between the United States and the Soviet Union, which prompted a general American retreat from prosecuting Japan, its new democratic ally in East Asia, as well as the internal processes at the IPS that favored more blatant incidents of Japanese wartime aggression—such as the well-documented 1937 "Rape of Nanjing" and abuses of Allied prisoners of war. After the silence imposed at the IMTFE, chemical and biological weapons proliferated with few restraints until the Cold War ended in 1992. At the same time, the international framework for war crimes prosecution greatly changed with greater attention put on crimes against civilians. Yet, lacking precedent, international readiness to legally sanction violations of the Geneva Protocol—as with the

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B. Friedrich et al. (eds.), *One Hundred Years of Chemical Warfare: Research, Deployment, Consequences*, DOI 10.1007/978-3-319-51664-6_15

2013 and 2017 murders of Syrian civilians with nerve gas—remains nearly as ambiguous as it was in 1946.

1 Introduction

Much of the history of war in the nineteenth and twentieth centuries was shaped by the great tension between advanced mechanized warfare and the idealistic ventures that arose to stop its mounting catastrophic impact. The nineteenth-century rise of national armies and industrial advances in weaponry began a pattern of increasingly destructive conflicts—the mass slaughter of troops and ruination of terrain—followed by valiant attempts to restrict the conduct of war, which were then followed by worse wars with more dangerously powerful and efficient weapons. The battlefield carnage and economic disruption caused by the Crimean War (1853–1856) and the American Civil War (1861–1865) were deplored. Yet in their aftermath, major state militaries plunged ahead to acquire more efficiently designed rifles, mobile heavy artillery, and machine guns.

The 1899 and 1907 Hague Conventions were a breakthrough in articulating new norms to reinforce the concept that the "right of belligerents to adopt means of injuring the enemy is not unlimited" (Boserup 1973, 152). Along with promoting the rights of prisoners of war and the protection of hospital ships, the conventions addressed specific weapons. The use of armed balloons on civilian populations and of expanding "Dum Dum" bullets (named after the British factory in India that produced them) were prohibited. The use of "smoke and noxious gas" in war was also prohibited, no small matter at the time (Hudson 1931). The role of chemicals in the production of weapons was well established and accelerating, with a growing impact on battlefield combat (Smart 2004). Gunpowder produced sickening sulfur fumes; sulfuric acid was used to make nitric acid, which was then used to make mercury fulminate for percussion caps, which meant more toxic clouds from explosives. New ideas to make weapons of chloroform, hydrochloric acid, cyanide, arsenic, and nauseating smokes and stink bombs in war started circulating in the 1860s. Other toxic substances poised for military use were chlorine, hydrogen cyanide, cyanogen chloride, phosgene, and mustard agent, all discovered or synthesized in the late eighteenth and early nineteenth centuries (Sartori 1943).

The 1907 Hague Conventions extended the 1899 provisions beyond their original five-year limit. The major Western powers appeared committed to the conventions, as did Japan and China. In 1915, though, Europe blundered into World War I and a new epoch of weapons innovations began. This time, long-range mortar, tanks, submarines with torpedoes, and the introduction of fighter airplanes expanded the dimensions of battle.

A major innovation in World War I was the introduction of chemical weapons, invented to overcome the conventional boundaries of trench warfare. In April 1915 at Ypres in Belgium, the German military released 150 tons of chlorine gas from a

lineup of 5700 canisters. Carried by the wind, the gas passed in minutes to the French and British trenches and quickly killed 1000 soldiers and injured another 4000. This surprise attack provoked competition to discover more potent chemical weapons, with the Germans, British, Italians, Russians, and later the Americans engaging in an unprecedented arms race (Lepick 1998). Soon phosgene, mustard gas, and an assortment of tear gases and blistering agents (vesicants) were in battlefield use, causing death, burns, blindness, other injuries, and terror among surviving combatants. The race was also on to develop masks, suits, and blankets that could protect troops from gas attacks.

World War I brought a scale of devastation in terms of deaths and economic and political upheaval that outstripped all previous wars (MacMillan 2013). When it ended in 1918, international cooperation among nations, backed by law, appeared necessary to prevent future chaos. Supported by a range of visionaries, the creation of the League of Nations in 1920 heralded a new, institutional approach to peace centered on the political resolution of state conflicts before they escalated (Kennedy 1987). Members would, in theory, submit to arbitration rather than take up arms and they would act in each other's defense in the event of unprovoked aggression. The 1922 establishment of the Permanent Court of International Justice (PCIJ) at The Hague offered the option for member nations to settle their disputes through legal hearings, which they did, at a rate of five cases per year for the next decade (ICC 2012).

The League also promised a radically new era of arms control. By Article 8 of its Covenant, members affirmed that "the maintenance of peace requires the reduction of national armaments to the lowest point consistent with national safety and the enforcement by common action of international obligations" (Ames 1922, 306). Also in Article 8, member states agreed to "full and frank information as to the scale of their armaments, their military, naval and air programs and the condition of such of their industries as are adaptable to warlike purposes." Although the United States, reverting to an isolationist posture, refused to join the League, its representatives maintained an active presence in its deliberations and arms control initiatives. The new Soviet Union was distinctly an outsider, but its emissaries did attend important debates.

In addition to the League's active agenda, the international community began building on the 1907 Hague Conventions. In the spirit of arms control, Americans took the lead in assembling the 1922 Washington Conference on the Limitation of Armaments, which resulted in a treaty to restrict poison gas and submarine warfare (SIPRI 1971, 46–47). The United States, the United Kingdom, France, Italy, and Japan, recognized as the premier military power in the Far East, signed the treaty. Because of French objections to the provisions about submarines, the Washington Treaty of 1922 never came into force; yet it paved the way for the 1925 Geneva Protocol which forbade the use of chemical weapons in war. The text of the Protocol banned the use of "asphyxiating, poisonous or other gases, and of all analogous liquids, materials or devices" already "justly condemned by the general

opinion of the civilized world" and "universally accepted as part of International Law, binding alike the conscience and the practice of nations" (SIPRI 1971, 341). To this provision, the treaty added that the prohibition would be extended to a looming innovation, "the use of bacteriological methods of warfare."

Despite its strong resolve, the Protocol raised an uncomfortable issue: what would be the international political repercussions if it were violated? In principle, the reaction of the League of Nations should have been two-fold: that the member states would act as restraints on each other and that, as a bloc, they would come to the aid of any member aggressed upon by another state. The implication of the treaty's text was that even states opting not to join would be beholden to established laws of war.

The Geneva Protocol was widely embraced in the interwar years; 43 nations became parties, with the British Empire, France, Italy, Germany, and the Soviet Union leading the way. From the outset, however, it was no guarantee against chemical or biological weapons proliferation. Instead, it allowed a provision for retaliation in kind, which meant that, based on the perception of an imminent or even a long-range threat, each state on its own could decide the level of research, development, and munitions production it needed for adequate defense.

Two important nations, the United States and Japan, refused to join the treaty. In an isolationist phase, the US Senate refused to ratify the Protocol, although sentiments against chemical warfare were strong in America and the US Army had little inclination to reenact the excesses of World War I (Brown 2006, 49–96). In principle, the United States adhered to the treaty's ban on use and limited itself to retaliation in kind. Its Chemical Warfare Service, invented late in World War I, languished and it had little inclination to investigate germ weapons (Guillemin 2005, 27).

Japan refused to become a party to the Geneva Protocol for different reasons. Having shown its military strength in its 1905 war with Russia, Japan was considered Asia's most advanced nation by Western powers, especially the British and Americans. With its population and industries growing and its natural resources limited, Japan had already annexed Korea, acquired Taiwan, and established a profitable lease for trade in Manchuria (Northeastern China). As Japan's ambitions to solidify its empire grew, so did its interest in modern, science-based weapons, including chemicals. During World War I, the Japanese military was more intrigued than repelled by Europe's chemical warfare and, following the war, its experts moved ahead to develop chemical agents with techniques learned in Germany and the United States. In 1928, Japan built a production facility on Okunoshima Island, near Hiroshima, mainly for mustard and tear gases. By that time, its Army Institute of Scientific Research included forty chemical weapons laboratories, twenty affiliated workshops, and an annex staffed with hundreds of scientists and technicians (Grunden 2005, 181–182).

2 World War II and the Post-war IMTFE

Even as the League advocated peace, the concept of total war, with scenarios of air attacks on enemy civilians, cities, and industrial centers behind the lines, was taking hold among state powers (Buckley 1999). As early as 1921, the Italian General Giulio Douhet, a pioneer of strategic bombing, predicted that aeronautics would open up a revolutionary new way to make war. "Air power makes it possible," he wrote, "not only to make high explosive bombing raids over any sector of the enemy's territory, but also to ravage his whole country by chemical and bacteriological warfare" (Douhet 1942, 6–7).

In the early 1930s, the legal means to lasting peace began unraveling. One of the first aggressive actions came from Japan, where moderates and militarists struggled over how to achieve Japan's destiny as a great power (Jansen 2002, 576–585; Gordon 2014, 181–199). In 1931, feeling the impact of the great world depression —its foreign trade had been halved since 1929—Japan made a move that violated the international "Open Door" policy for China that it had agreed to in 1922, in affirmation of China's right to sovereignty, territorial integrity, and control of its national destiny. Claiming Chinese troops had attacked the Japanese Kwantung Army at a railway junction near Mukden (Shenyang), Japanese troops soon conquered Manchuria. At a meeting in Geneva in February 1933, League members voted for Japan's withdrawal. Japan's reaction was to quit the League. That year, Nazi-controlled Germany also quit, claiming that the League's World Disarmament Conference had acted with prejudice by denying it arms parity with France.

Fascist Italy was the next to leave the League. Its 1934–1936 war with Ethiopia was patently aimed at increasing Italy's colonial holdings in Africa. The League attempted reconciliation between the two members, but to no avail. Starting in December 1935, Italy violated the Geneva Protocol by using asphyxiating and poisonous gases on undefended Ethiopian troops and civilians (SIPRI 1971, 175–189). The response of League members was uneven and tepid, establishing a precedent of non-intervention. Despite protests from Ethiopia's Emperor Haile Selassie and documented proof of gas casualties from Red Cross physicians, the League failed to implement effective military and trade sanctions against Italy or deter further gas attacks. The conflict ended in May 1936 with Ethiopia's defeat and its incorporation into Italian East Africa. Italy exited the League soon after.

In July 1937, the Japanese used a conflict on a rail line near Beijing as an excuse to instigate war against China to expand their territory. After quickly gaining control of Beijing, the Japanese captured Shanghai and then China's capital Nanjing. League members protested, but none rushed to openly confront Japan in China's defense. In October of that year, China's delegates to the League protested Japan's use of chemical weapons (identified as mustard gas) on defenseless Chinese troops on the path from Shanghai to Nanjing (SIPRI 1971, 189–192). In 1938, the Chinese returned with documented accusations of more Japanese chemical attacks. But as in the case of Italy's attacks on Ethiopia, League

members did not rise to China's defense; it could only remind its members that "the civilized world" had rejected chemical weapons.

On September 1, 1939, Germany invaded Poland and another catastrophic world war began. By then, Germany, Italy, and Japan had found common ground in their alliance as Axis powers, which was sealed by the 1940 Tripartite Pact. Japan's surprise attack on Pearl Harbor in December 1941 brought the United States into the war and extended the Allied-Axis conflict to the Pacific and Asia. In 1942, the Chinese reported to the Allies that Japan had attacked four of its cities with plague, killing hundreds; in the tumult of the war, BW experts in the United Kingdom and the United States dismissed this complaint as not credible (Guillemin 2017, 15).

In a short time, World War II demonstrated that, armed with advanced weapons, especially long-range bombers, major industrial nations at war could wreck the globe (Buruma 2013). From 1939 to 1945, some 60 million people were killed, once-thriving cities and natural environments were laid waste, major states went bankrupt or nearly so, masses of people were forced to migrate and died of epidemics, exposure, or starvation, and political instability became a norm. In Germany, Poland, and the Soviet Union, entire populations were murdered in Nazi concentration camps and in mass executions on the eastern front. Allied troops died by the hundreds of thousands on the western front, German and Soviet soldiers died by the millions in the East. In the Pacific-Asia region, the estimated body counts, difficult to reckon in poor and disadvantaged countries, matched those in Europe.

At the war's end, the Allied response was to create the United Nations as a fortified reincarnation of the League of Nations—this time with a provision for armed peace-keeping intervention and a new court for conflict resolution. A complementary Allied response was to invent the international military tribunal (IMT), staging one in Nuremberg, Germany, and the other in Tokyo, to prosecute the high Axis leaders individually for their war crimes. Three major criminal charges were agreed on: first, for the waging of aggressive war (including conspiracy in its promotion and planning); second, for the violation of the customary rules of war; and, third, for crimes against humanity, pertaining especially to the torture and killing of civilians (Taylor 1992, 56–74).

Compared to the spirit of the immediate post-World War I years, the fervor for arms control in 1945 was singularly lacking. To the contrary, advanced weaponry was competitively sought. The Allies in Europe (the Americans, British, Soviets, and the French) sought to appropriate as much as they could of Nazi Germany's arsenals, from V-2 rockets to nerve gases (Jacobsen 2014). In recruiting expert German physicists, chemists, and biologists, the unsavory and even criminal aspects of their careers were suppressed. Similarly, in Japan, the US Army and its G-2 intelligence division in Tokyo diligently sought to ascertain what, if any advances in weaponry could be acquired as "war booty" (Home and Low 1993). The mobilization of American industry and science for military goals had succeeded in winning the war; the result was a validation of strategic weapons, from incendiaries to conventional bomb, culminating in the atom bomb which immediately became "a symbol of industrial might, scientific accomplishment, and national prestige" (Cirincione 2007, 17).

In principle, the second category of IMT war crimes, concerning customary rules of war, included violations of the Hague Conventions and the 1925 Geneva Protocol, along with treaties on the treatment of POWs and non-combatants. Encouraged, China decided to revive its wartime chemical and biological warfare charges against Imperial Japan. The Japanese had signed the Hague Conventions and, although not a party to the Geneva Protocol, the ban on chemical and bacteriological weapons use in war was internationally accepted. With that intent, along with charges of unprovoked war and mass killings, Chinese prosecutors arrived early at the International Military Tribunal of the Far East (IMTFE), which began organizing in December 1945 and opened in May 1946.

Using basically the same charter as the Nuremberg International Military Tribunal (1945–1946), the IMTFE put 28 defendants on trial, including former Ministers of War and those who had been high-ranking field commanders in Manchuria and China. Since Nazi Germany had refrained from using its chemical weapons during the war and had not developed biological weapons, the Protocol was fairly irrelevant at Nuremberg. The Chinese calculated that the Tokyo trial was the right forum to settle its old CBW scores.

3 Retrieving CBW Evidence from China, 1946

Eleven nations were represented at the IMTFE: the United States, the United Kingdom, the Soviet Union, France, China, Australia, New Zealand, the Netherlands, India, and the Philippines. Each was entitled to send an Associate Prosecutor to head its division at the International Prosecution Section (IPS), the IMTFE's cooperative organization for selecting defendants, composing the Indictment, and arguing the Allied cases. The IPS was also in charge of organizing war crimes evidence against those accused. The Chinese Section had virtually no staff, just its lead prosecutor, Hsiang Che-chun (Xiang Zhejun), and his assistant, Henry Chiu. In an unusual gesture of support, Joseph B. Keenan, the IPS Chief of Counsel, sent an investigative team to China on a month-long investigation to track evidence and identify witnesses who could testify at the trial on behalf of the Chinese Division (Keenan 1946).

On March 12, 1946, two American IPS lawyers, Colonel Thomas Morrow and civilian David Nelson Sutton, along with Henry Chiu, began their investigation, which took them to Shanghai, Beijing, Chongqing, and Nanjing (Guillemin 2017, 105–157).

Sutton was responsible for investigating the BW allegations, which proved difficult. He interviewed knowledgeable public health physicians who had reported on the plague outbreaks, but none had actually seen the Japanese air attacks, which had targeted small war-torn cities in Central and South China. No testimony at the time had been taken from victims and Sutton had no mandate to conduct an

intensive field inquiry. General Ishii Shiro, the leader of the Japanese germ weapons program, centered at Unit 731 in Manchuria, had cleverly intended to mask the plague attacks so that they would seem to be naturally caused—and he had largely succeeded. Sutton was able to gather substantial evidence for Japan's 1937 conquest of Nanjing and the ensuing seven weeks of massacres, rapes, and looting, and for the Japanese opium enterprise, which had enslaved many Chinese communities, but not for the plague attacks.

After returning to Tokyo, Sutton submitted his report on allegations of Japanese bacteriological warfare to Chief of Counsel Keenan. He also sent a copy to General Douglas MacArthur, Supreme Commander for the Allied Powers (SCAP) and head of the Allied Occupation, the ultimate authority in Tokyo, even though he professed to keep a distance from the IMTFE. Sutton's conclusion was succinct: "As the case now stands, in my opinion the evidence is not sufficient to justify the charge of bacteria warfare" (Sutton 1946, 1).

Morrow and Sutton were both aware that a CWS officer was in the process of interviewing General Ishii and a dozen of his former Unit 731 staff; the news had been leaked to the military newspaper *Stars and Stripes* the previous February (Kalisher 1946). That inquiry, Morrow had been advised, was for CWS and G-2 "war booty" purposes alone. Although Sutton later made other inquiries about Japan's BW program, IPS was left with his original assessment: the evidence for Japanese BW, which killed hundreds and terrorized thousands, was insufficient for prosecution. Another question troubling the Chinese charge concerned the problem of linking any such attacks to particular defendants in the dock. How could germ weapons be developed and used without the knowledge of the high command in Tokyo?

In contrast to Sutton's BW inquiry, Colonel Morrow's March–April 1946 investigation of Japanese chemical weapons use in China yielded documents and eye-witness accounts highly suitable for trial. On returning to Tokyo, Morrow wrote up a detailed summary of what he had acquired and, on May 13, he and Kenneth N. Parkinson, another IPS attorney, included it in their "Form of Brief" on "All China Military Aggression, 1937–1945," which they submitted to Chief of Counsel Keenan and to General MacArthur (Parkinson and Morrow 1946a). Following a detailed IPS outline, the draft described each of the relevant counts of the Indictment as they related to China's charges against Japan and it listed the names of witnesses ready to testify. The summary covered the Sino-Japanese War from July 7, 1937 until Japan's surrender in September 1945.

Colonel Morrow's special contribution to the draft was his evidence for Japanese CW against China, which he included with Japan's other war crimes:

> This waging of war by Japan in China was characterized by gross violations of international law and treaties, by massacre of civilians and Chinese soldiers, prisoners of war, and by the outlawed use of poison gas (Parkinson and Morrow 1946a, 7–8).

Starting with potential trial witnesses, Morrow drew on an affidavit from a Major General Chang, deputy director of China's Army Medical Corps, who stated that the Japanese used poison gas at Ichang (outside Shanghai), where Chang

"personally saw men who were burned about the eyes, arm pits, and the crotch whose cases were diagnosed by himself. He saw 30 or 40 soldiers affected this way." (Parkinson and Morrow 1946a, 8). A photographer at the scene, a gas defense officer of the 34th Army group, could testify to having observed the soldiers burnt by vesicant gas. In addition, Brigadier General Wang Chang Ling, director of the gas defensive administration, could testify that in 1943 he found on the battlefield fifteen-centimeter howitzer shells containing hydrocyanic acid and that he saw a dozen soldiers suffering from gas poisoning by the Japanese, three of whom died. The general still had his notebook describing the analyses of contents of the shells. Finally, the director of a museum of chemical munitions near Chongqing was willing to describe the spent Japanese vesicant bombs and shells that he and others had brought back from battlefields.

As for official data, Major Woo Chia Shing of the Chinese Army, a custodian of records obtained from the Japan's Ministry of War in Tokyo, stated that 26,968 persons were injured by poison gas in the Sino-Japanese War, of whom 2086 died. These records, he said, verified that gas was used by the Japanese 1312 times in ten battles (Parkinson and Morrow 1946a, 8). Morrow then referred to Japan's secret chemical plant at Okunoshima.

> Weapons from there, including mustard and lewisite, were shipped to China; Documents and testimony from Japanese officers connected with chemical warfare indicated that gas warfare was used in emergencies with the permission of Tokyo up to and including 1942 (Parkinson and Morrow 1946a, 8).

Meanwhile, the US Chemical Warfare Service (CWS) had an interest in not having Japanese chemical weapons use prosecuted as a war crime; that notoriety could only limit its own agenda to develop offensive weapons. While Morrow was still in China, Lieutenant Colonel John Beebe from the CWS office in Tokyo began conducting his own inquiry—which was part of larger G-2 project to assess Japan's chemical weapons. First Beebe interviewed former Premier Tojo Hideki and former War Minister Hata Shunroko, then being held at Sugamo Prison, and then, in addition, four other Japanese officers who might know about Japan's chemical arsenal and use.

In response to Beebe's questioning, Tojo insisted that although chemical stocks had been produced, none had been used and could not have been used without his permission. He had heard President Roosevelt's 1942 warning about retaliation in kind:

> I thought, as I had from the beginning, that the use of gas would be disadvantageous for Japan because of tremendous America's industrial capacity and this statement of the President strengthened my own ideas (Interrogation of Tojo 1946, 4).

Tojo admitted that the Japanese did use "harassing agents" such as sneezing agents, tear gas, and smoke (as opposed to "casualty agents"). When asked if these non-lethal weapons were banned by international treaties, he replied defensively that police forces all over the world used them with impunity, including those in the United States who wanted to quell riots. "And what about the atom bomb?" he

added. Changing the subject, Beebe confronted him with Japanese field reports that Chinese soldiers had died of asphyxiation from gas attacks, with blood running out of their noses and mouths. Tojo attributed these deaths to the Chinese overreactions to harassing agents and to their sometimes fatal inexperience with using gas masks.

General Hata had been in command of the Central China Expeditionary Force in 1938 and in 1941–1944 he was the Commander-in Chief of all the China armies. He denied any Japanese use of chemical weapons, allowing only that sneezing and tear gas might have been used (Interrogation of Hata 1946), nor had he ever heard of China's complaint to the League of Nations. The four other officers Beebe interviewed similarly denied that any chemical warfare had been waged against the Chinese. One, a former commander at the Narachino Chemical Warfare School, admitted to the production of some munitions but insisted that the high command had forbidden chemical attacks. "If gas were used in China," he said, "it was just on the spur of the moment and not on the orders of high authorities" (Interrogation of Yokoyama 1946, 5).

If presented in court, would Colonel Morrow's CW evidence be enough to counter these denials? The opportunity never arose, due to the influence of CWS working with US military intelligence in Tokyo. In mid-May, Morrow was advised of the content of Beebe's interrogation and the argument for "the outlawed use of poison gas" was erased from the "All China Military Aggression" report. In its final version, dated May 24, Japan's use of "poison gas" was briefly mentioned in passing on its first page, and the Tokyo document citing Chinese chemical casualties of 26,968, including 2086 who died, was repeated from the earlier version, along with the admission that Japan was known to have manufactured "various types of poisonous gases." But all the trial-worthy evidence—the eyewitness testimony, diaries, photographs, and medical records of victims, the retrieved battlefield munitions—was excised (Parkinson and Morrow 1946b).

In addition, reasons were inserted, taken straight from Lieutenant Colonel Beebe's interviews of Tojo and Hata, why allegations against Japan should not be "over-emphasized." As the authors explained:

> 1) It does appear that gas was used only in emergencies and for the most part tear, sneezing, and vomiting gas was used and not the vesicants, 2) the amount of casualties inflicted on the Chinese as evidenced from their statistics was a very small proportion of the total casualties suffered by the Chinese during the war, which is well over 3,800,000 according to their own records, and 3) in their interrogations Generals Hata and Togo refer to the fact that in the United States we have used poisonous gases such as sneezing, vomiting and tear gasses in labor disputes and General Togo in his interrogation about gas, raises the question, "How about the atomic bomb?' which he claims is a much more outrageous weapon of warfare than poisonous gas (Parkinson and Morrow 1946b, 31–32).

The intimation of this last point was that if chemical warfare charges were made against Japan, the defense would have leeway to introduce the Hiroshima and Nagasaki bombings as a way of undermining the legitimacy of American prosecutors.

The revised report then dismissed China's first report to the League, and with it any reference to existing treaties:

> The reference to the use of poison gas in this warfare appears to have been made in the form of a complaint by the Chinese to the effect that the Japanese army used gas in Shanghai three and four October 1937, but which the Japanese emphatically deny. We do not intend to offer this in evidence but merely invite the committee's attention (Parkinson and Morrow 1946b, 32).

From then on, as IPS was informed, all future evidence about Japan's alleged chemical weapons use would be distributed to staff by the head of the CWS office in Tokyo, Colonel Geoffrey Marshall.

With its criminal charges of chemical warfare reduced to complaints and its germ weapons charges without solid proof, the Chinese Division, heavily reliant on American support, focused on the prosecution of the more flagrant Japanese crimes resulting from "aggressive war" and on their "total casualties." These charges were successfully argued, with convictions of top Japanese leaders from the time of the conquest of Manchuria to the 1937 instigation of the Sino-Japanese War and through to August 1945 and Japan's surrender to the Allies. In November 1948, seven defendants, including Tojo, were sentenced to death by hanging, while the rest were given jail sentences ranging from life to seven years, with the exception of two of the accused who died during the trial and another who spent the trial in a mental institution (Brackman 1987, 454–462).

4 Conclusion

Over the years, the IMTFE has been criticized as an example of hypocritical "victor's justice" for its prosecution of war crimes—like the killing of civilians or abuses of POWs—of which the Allies and particularly the United States were themselves guilty (Totani 2008, 218–245).

The obstacles to justice that G-2 and the Chemical Warfare Service posed at IPS were too covert to attract public notice. By the summer of 1946, General Willoughby controlled all witness interrogations at IPS—in the name of national security—and he later engaged leading lawyers at IPS and General MacArthur in his project to protect General Ishii and some two dozen of his scientists from war crimes prosecution for inhumane medical experimentation and their role in multiple mass germ attacks on Central China in 1942 (Guillemin 2017, 244–284).

In the 70 years since the IMTFE, the history of chemical and biological weapons proceeded from state-level proliferation on an extravagant scale, at immeasurable cost, to eventual international restraints. The proliferation began with the United States and its Western allies and with the Soviet Union, which legitimized the Cold War excesses. In combination with nuclear arms, chemical and biological weapons became integral to the "weapons of mass destruction" model for small and developing nations in troubled regions of the world. The legal restraints began with

President Richard Nixon's unexpected 1969 renunciation of offensive biological weapons on behalf of the United States and the 1972 Biological Weapons Convention and, after the end of the Cold War, the culmination of the 1993 Chemical Weapons Convention and its organized destruction of state CW munitions—a process that both increases political stability and public safety.

In retrospect, chemical weapons were early on recognized as deplorable and, had the world known of Japan's germ attacks on the Chinese, those weapons, too, would have been reviled and perhaps criminalized at the IMTFE. On a purely practical level, major states were late in understanding that, compared to conventional arsenals, chemical and biological weapons were cumbersome, liable to endanger friendly troops and civilians, and inefficient, given their unpredictable impact on targets. Nor had chemical and biological arms the annihilating power of atomic bombs, no matter how much their advocates over the years were able to persuade those who controlled state military budgets that strategic capability was always one step away.

A post-facto evaluation of chemical weapons as archaic is cold comfort for those populations who suffered from the post-war proliferation. These victims, as might have been predicted, were always defenseless populations. Egypt's attacks on Yemen in the 1960s and, worse, Saddam Hussein's use of poison gas during the 1980s Iran-Iraq War reached a crescendo with his nerve gas attacks on Kurdish villages.

The latest spill-over from the long years of proliferation is the 2013 sarin attacks on Syrian civilians in Ghouta, outside Damascus, a war crime for which proof of accountability has been lost, for the time being, in the fog of war, along with the 2017 sarin attacks in Kahn Sheykun in northern Syria. As with the Chinese in 1945, one hopes for justice in the name of victims of chemical or biological attacks. But what might that forum be? In 1949, Harvey Northcroft, the New Zealand judge at the IMTFE, wrote passionately of the need for a disinterested international war crimes court:

> No nation or nations which established their own tribunals, when such a Permanent Court existed, could escape the imputation that their action was dictated by the desire for vengeance, or by other improper motives. A Permanent Criminal Court would, therefore, provide the greatest possible measure of insurance against the unscrupulous use of power by victorious nations in the future (Northcroft 1982, 136–137).

More than fifty years later, in 2003, the International Criminal Court (ICC), a United Nations initiative, opened as an independent resource for victims and states with no other avenues to justice. While the ICC represents a step forward in international criminal law, its few cases have been selected with care (prosecution on behalf of child soldiers in the Congo wars was its first), adjudicated slowly, and have addressed mostly sub-Saharan African conflicts. Echoing the Geneva Protocol, Article 8 of its statute refers to criminal sanctions against "employing poison or poisoned weapons" or "prohibited gases, liquids, materials or devices" such that any would cause "serious damage to health in the ordinary course of events, through its asphyxiating or toxic properties" (Schabas 2001, 305).

The statute is clear, yet the court's mission focuses on international armed conflict rather than civil wars or internal conflicts. It is questionable whether weapons-specific atrocities would by themselves make a compelling case, even when civilians were murdered. In addition, in its brief history, the ICC has had to navigate between pressures from the United Nations Security Council and the uncertain cooperation of states in conflict zones, while also being burdened by the complexities of its own organizational evolution (Minow et al. 2015). The future will see whether those responsible for the sarin attacks on Ghouta will someday sit accused in the dock at the ICC or another court and whether the charges are framed as war crimes or, in broader acknowledgement of the harm done to civilians, as crimes against humanity.

References

Ames, C.B. 1922. Article Eight of the League of Nations. *The Southwestern Political Science Quarterly* 2: 302–310.

Boserup, Anders. 1973. *The problem of chemical and biological warfare: CBW and the Law of War*, vol III. New York: Humanities Press.

Brackman, Arnold C. 1987. *The other Nuremberg: The untold story of the Tokyo war crimes trials*. New York: William Morrow.

Brown, Frederic J. 2006. *Chemical warfare: A study in restraints*. New Brunswick: Transaction Books.

Buckley, John. 1999. *Air power in the age of total war*. Bloomington: Indiana University Press.

Buruma, Ian. 2013. *Year zero: A history of 1945*. New York: Penguin Press.

Cirincione, Joseph. 2007. *Bomb scare: The history and future of nuclear weapons*. New York: Columbia University Press.

Douhet, Giulio. 1942. *Command of the air*. Trans. Dino Ferrari. London: Faber & Faber.

Gordon, Andrew. 2014. *A modern history of Japan: From Tokugawa to the present*. New York: Oxford University Press.

Grunden, Walter E. 2005. *Secret weapons and World War II: Japan in the shadow of Big Science*. Lawrence: University Press of Kansas.

Guillemin, Jeanne. 2005. *Biological weapons: From state-sponsored programs to contemporary bioterrorism*. New York: Columbia University Press.

Guillemin, Jeanne. 2017. *Hidden Atrocities: Japanese germ warfare and American obstruction of justice at the Tokyo trial*. New York: Columbia University Press.

Home, R.W., and Morris F. Low. 1993. Post-war scientific intelligence missions to Japan. *ISIS* 84: 527–537.

Hudson, Manley O. 1931. Present status of the Hague Conventions of 1899 and 1907. *American Journal of International Law* 25: 114–117.

International Criminal Court (ICC). 2012. *History of the PCIJ*. http://www.icj-cij.org/en/history. Accessed 10 Mar 2016.

Interrogation of General Shunroku Hata. 1946. US National Archives, Japanese War Crimes (JWC), RG496, Entry UD UP53, Box 342, Folder C-306, April 11.

Interrogation of Hideki Tojo. 1946. US National Archives, JWC, RG496, Entry UD UP53, Box 342, Folder C-306, April 2.

Interrogation of Takeshige Yokoyama. 1946. US National Archives, JWC, RG496, Entry UD UP53, Box 342, Folder C-305, April 17.

Jacobsen, Annie. 2014. *Operation Paperclip: The secret intelligence program that brought Nazi scientists to America*. New York: Little, Brown.
Jansen, Marius B. 2002. *The making of modern Japan*. Cambridge: Harvard University Press.
Kalisher, Peter. 1946. SCAP locates and questions Gen. Ishii. *Pacific stars and stripes*, February 27.
Keenan, Joseph B. 1946. Directions to Sutton from Keenan. Tokyo war crimes trial collection, University of Virginia Law School, Section 1, Folder 1, MSSI Su 863a, March 3.
Kennedy, David. 1987. The move to institutions. *Cardozo Law Review* 8: 841–988.
Lepick, Olivier. 1998. *La Grande Guerre chimique*. Paris: Presses Universitaires de France.
MacMillan, Margaret. 2013. *The War That Ended Peace: The Road to 1914*. New York: Random House.
Minow, Martha, True-Frost, C. Cora, and Whiting, Alex, eds. 2015. *The First Global Prosecutor: Promises and Constraints*. Ann Arbor: University of Michigan Press.
Northcroft, Harvey. 1982. The Former New Zealand Member, International Military Tribunal for the Far East, to the Prime Minister, 17 March 1949. In *Documents on New Zealand external relations*: *The surrender and occupation of Japan*, vol. 2, ed. Robin Kay, 1736–1737. Wellington, New Zealand: P.D. Hasselberg.
Parkinson, Kenneth N., and Colonel Thomas H. Morrow. 1946a. Trial Brief All China Military Aggression, 1937–1945. Tokyo War Crimes Trial Collection, University of Virginia Law School, Box 2, Folder 2, MSS 93–4, May 13.
Parkinson, Kenneth N. and Colonel Thomas H. Morrow. 1946b. Trial Brief All China Military Aggression, 1937–1945. Tokyo War Crimes Trial Collection, University of Virginia Law Library, Box 3, Folder 4. MSS93–4, May 24.
Sartori, Mario. 1943. *The war gases*. New York: D. Van Nostrand.
Schabas, William A. 2001. *An introduction to the International Criminal Court*. Cambridge: Cambridge University Press.
SIPRI (Stockholm International Peace Research Institute). 1971. *The Problem of Chemical and Biological Warfare*: *CB Disarmament Negotiations, 1920–1970*, vol. 4. New York: Humanities Press.
Smart, Jeffrey K. 2004. History notes: Chemical and biological research and development during the civil war. *CBIAC Newsletter* 5: 3–11.
Sutton, David Nelson. 1946. Subject: Bacteria warfare. David Nelson Sutton Collection, University of Richmond Law Library, Folder 13, April 25.
Taylor, Telford. 1992. *The anatomy of the Nuremberg trials*. New York: Knopf.
Totani, Yuma. 2008. *The Tokyo war crimes trial: The pursuit of justice in the wake of World War II*. Cambridge: Harvard University Asia Center.