The Road to Ypres: The Beginnings of Gas Warfare in World War I*

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On the afternoon of April 22, 1915, a large volume of compressed chlorine, probably close to 150 tons, was released from thousands of storage cylinders in the German trenches along the northern arc of the Ypres salient. Within minutes, dense clouds of the asphyxiating gas drifted with the wind into a four-mile-wide sector held by units of the French Forty-fifth (Algerian) and Eighty-seventh (Territorial) Divisions, killing some soldiers outright, seriously incapacitating many more, and causing hasty withdrawals of the others in much of the affected area.¹ Although a broad gap was thereby temporarily opened in the Allied lines, the Germans did not fully exploit their advantage. By the end of the day their infantry had overrun part of the Ypres salient and captured over fifty French and British guns, but no strategically decisive breakthrough was attempted or achieved.²

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¹ Some recent accounts, e.g., Seymour M. Hersh, Chemical and Biological Warfare (London, 1968), p. 5, list French gas casualties as over 5,000 killed and another 10,000 injured. Both of these figures are far too high. Contemporary German reports indicate that few bodies were found in the gassed area, and the death rate among about 200 seriously incapacitated French soldiers who were later taken to German hospitals was well below 10 percent. See Lt. Gen. Waldorf to HQ XXVI Reservekorps, April 27, 1915, Nachlass Otto Freiherr von Hügel [hereafter Hügel papers], Württembergisches Hauptstaatsarchiv Stuttgart [hereafter WHA]; XXVI Reservekorps to A.O.K. 4, April 29, 1915, ibid.; and Rudolf Hanslian, Der deutsche Gasangriff bei Ypern am 22. April 1915 (Berlin, 1934), pp. 64, 70, 104 and passim. For similar findings by medical officers on the Allied side of the line, see Sir Andrew Macphail, The Medical Services, Official History of the Canadian Forces in the Great War (Ottawa, 1925), p. 300; and a French casualty report by the medical inspector Sieur, dated April 25, 1915, which refers to 625 gassed soldiers counted as of the previous day, of whom three died of congestion of the lungs (information supplied by Dr. L. F. Haber, who found the report in Box 16 N 826 at the military archives, Vincennes).

² See the official accounts in Reichsarchiv et al., Der Weltkrieg 1914 bis 1918: Die militärischen Operationen zu Lande [hereafter RA, Weltkrieg], 14 vols. (Berlin,
The release of "poison gas" against Allied troops, which was repeated two days later during an assault on Canadian positions in the adjacent sector, near Saint-Julien, provoked great indignation in the Western world and was denounced by many Allied leaders as a flagrant breach of the rules and customs of war and an offense against all humane principles.³ Although a number of historians and military men have since pointed out that the "illegality" and "inhumanity" of the German gas attacks were not really all that clear, many Western authors have continued to take a very dim view of what the Germans did at Ypres. There is widespread agreement, in particular, that their resort to gas weapons was completely unprovoked and, furthermore, that the German high command did not even have the wit to use the odious new technique for a strategically significant purpose but wasted it, and thus the all-important surprise effect, on a limited offensive with inadequate reserves.⁴

The purpose of this essay is to probe into the background of the Ypres operation and to reassess the military, technical, and moral aspects of imperial Germany's pioneering role in the development and use of "chemical warfare" devices during the opening stages of World War I. Although many important documents bearing on these questions were unfortunately lost when the Potsdam Heeresarchiv burned down in 1945, some valuable records did survive in other places, making it possible to take a fresh look at this controversial subject.

Contrary to general belief, gas warfare in World War I did not begin at Ypres. Attempts to break the resistance of enemy troops


through the diffusion of noxious vapors had actually been started much earlier in the war—both by the French and by the Germans themselves.

While no definitive assessment of French front-line experiments with gas munitions prior to April 22, 1915 is possible until all relevant files in the military archives of France have been opened, some tentative conclusions on this subject can be drawn now. To begin with, it is now beyond question that small gas-diffusing projectiles of prewar design and manufacture, so-called *cartouches suffocantes*, were used by French troops in some sectors of the Western front as early as 1914. Intended primarily for attacks on fortifications, these projectiles were filled with ethyl bromo-acetate (in liquid form), weighed approximately half a pound, and were launched by special twenty-six-caliber rifles (*fusils lance-cartouches éclairantes*). By February 1915, hand grenades containing the same chemical agent, but of greater weight and volume and thus more suitable for assaults on open trenches, had been added to the stock of French gas munitions, and there are strong indications that some of these *grenades suffocantes* were used against German troops in the Argonne sector from mid-March on.

According to a confidential circular issued by the French war ministry on February 21, 1915, the vapors released by these two types of *engins suffocants* were “irritant” to the eyes, the nose, and the throat but, “at least in small dosage,” not actually “deleterious.” While this was certainly an accurate summary of the effect

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5 For an introduction to the historical controversy which erupted after World War I on the subject of French gas munitions, see the Swiss contribution by W. Volkart, “Der Giftgaskrieg und seine Entstehung,” *Allgemeine schweizerische Militärzeitung*, no. 2 (1926), pp. 69–78.

6 This was confirmed by Colonel Hurbin, adjoint au chef du Service historique de l’armée, Vincennes, in a letter to the author, March 26, 1971.

7 Information derived from ibid.; a follow-up communication from the Vincennes office, May 12, 1971; and the text of a French war ministry circular, “Notice sur les engins suffocants,” February 21, 1915. (An original of this circular fell into German hands during the war and was widely publicized in German postwar publications, but most Western authors either ignored it altogether or dismissed it as spurious. I wish to thank the Service historique de l’armée for confirming the authenticity and supplying me with a copy of the document.)

8 For a detailed description of the grenades and advice on their proper use in attacks on trenches, see Ministère de la Guerre, “Notice . . . ,” According to Colonel Hurbin, the grenades, as distinct from the less powerful *cartouches suffocantes*, were “not used” until after the Germans had staged their first chlorine attack. However, this information is hard to reconcile with the text of the “Notice . . . ,” and conflicts directly with German reports from the front in March and April which refer explicitly to French attacks with “hand grenades” or “bombs” of the gas-diffusing type.

9 See Ministère de la Guerre, “Notice . . . ,” last section.
produced by the detonation of individual missiles, it should be added that the chemical agent as such was not entirely harmless; that is, extended exposure to the vapor could cause severe choking and under some exceptional circumstances even prove lethal.\[10\]

Early in April 1915, General Joffre’s staff notified French senior commanders that a new type of chemical hand grenade, the “Bertrand No. 1,” was being placed “at the disposal of the armies,” and that the older *engins suffocants* were henceforth to be identified as the “1.914” (*sic*) models. While it is fairly certain that the new Bertrand grenades were filled with chloraceton,\[11\] no reliable information is as yet available as to when they were first used in actual combat.

As for the “1914” models, it appears from German reports that, because of their limited size and volume, they rarely caused more than temporary discomfort (irritation of the eyes, a choking sensation, etc.) among troops who were attacked with these missiles. Nevertheless, the very use of such devices by one of the Allied armies from the fall of 1914 did set a precedent of sorts, making it psychologically easier for the Germans to try out their own, and far more potent, gas weapons at the earliest opportunity.

Just as in France and Britain (where the War Office had started tests with chemical “irritants”—chloraceton and benzyl chloride—in the spring of 1914),\[12\] some military experiments with chemical agents had been conducted in Germany before the outbreak of the war. However, according to an extant memorandum by Colonel Max Bauer—the well-known artillery specialist in the Prussian general staff who later, in 1916, became General Ludendorff’s principal adviser on economic and political questions—the results of these German prewar tests had been “negative” throughout. Indeed, Bauer complained, not only was it necessary to start all over again during the war, “but the negative outcome of the experiments made before the war actually impeded the acceptance of the new results,

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\[11\] See Order no. 781, Grand quartier général, April 3, 1915, signed by Hellot (copy furnished by Service historique de l’armée). The reference to the chloraceton filling and other technical data are found in a penciled annotation on the original.

\[12\] The British prewar tests are described in a typescript “Historical Account of Offensive Chemical Warfare Research up to the Date of the Formation of the Chemical Advisory Committee in February 1916,” prepared by J. Davidson Pratt. I am indebted to Dr. Haber for bringing this material in the Public Record Office, MUN 5/385/1650/9, to my attention.
for one believed that the subject was already known and that it had been found unsuitable.”

Judging from Bauer’s papers and other sources, the decision to reopen work on chemical munitions was taken by the German high command (Oberste Heeresleitung [OHL]) in the second half of September 1914, that is, shortly after the great German setback at the Marne and the de facto replacement of the hapless von Moltke as chief of the general staff by the Prussian minister of war, Lt. Gen. Erich von Falkenhayn. While rumors and unconfirmed reports about Allied experiments with chemical munitions seem to have played some part in the deliberations at the OHL, the final decision was triggered primarily by concern over Germany’s rapidly dwindling powder and shell reserves and mounting complaints from the front that conventional high-explosive shells were relatively ineffective in dislodging the enemy from well-prepared trenches and other earthworks.

On personal instructions from General von Falkenhayn, Max Bauer—who was then a major and chief of the Heavy Artillery and Fortresses section in the Operations Branch at the OHL—early in October 1914 convened a small group of scientists and army officers on the Wahn artillery range near Cologne. The assigned task of the committee, which included Walther Nernst (a future Nobel laureate) and the director-general of the Leverkusen Farbenfabriken, Carl Duisberg, was to develop a chemical shell—of the “incendiary, smoke, irritant, or stink” type—that could be used to drive enemy troops from house cellars and other inaccessible places. Apparently at the suggestion of one member who had previously served at the front, the committee eventually decided to try out a nontoxic stenmutator, double salts of dianisidine, and recommended that the powdery substance be put into the standard shrapnels used by German field howitzers.

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15 See “Denkschrift betreffend den Gaskampf . . . ,” p. 3, Bauer papers; and
Production of these so-called Ni-shells must have begun very quickly, for about 3,000 of them were first used on October 27 in the area around Neuve-Chapelle. The effect of the sternutatory dust, however, appears to have been so slight that the Allies did not even know about its use until the matter was revealed in German postwar publications. Nevertheless, approximately 17,000 additional Ni-shells were turned out by German factories before the project was abandoned.16

Early in November, chemist Hans Tappen—whose brother Gerhard, at that time a colonel, was one of Falkenhayn’s closest advisers in his capacity as chief of the Operations Branch at general headquarters—proposed to the OHL that artillery shells be filled with xylyl bromide, a liquid which could be turned into an “irritant” vapor quite similar to that produced by the French engins suffocants. Major Bauer, it appears, initially rejected the proposal on the grounds that it was technically not feasible to fire shells with a liquid filling, but subsequent tests ordered by Colonel Tappen indicated that premature detonations and other malfunctions of such shells were unlikely to pose too much of a problem.17

Prototypes of the new ammunition (eventually code-named “T-shells” in recognition of Hans Tappen’s contribution) were initially tried out on the Kummersdorf artillery range near Berlin and subjected to various technical modifications. After a “large-scale” test at Wahn on January 9, 1915, which was attended by Falkenhayn, his quartermaster general, Adolf Wild von Hohenborn, and other top figures from the OHL, the new chemical shells (fifteen-centimeter caliber) were formally approved for use in the field.18
While laboratory work on the T-shell was still under way, sometime in December, one of the scientific consultants on that project, Fritz Haber, pointed out to the military authorities that chlorine gas, a potent “lung irritant,” might be an even more effective weapon for breaking the deadlock of trench warfare. As the director of the Kaiser Wilhelm Institut for physical chemistry in Berlin, Haber had already established a close working relationship with the Prussian war ministry during the opening months of the war. This relationship was now formalized by his appointment as head of a new “chemicals” section in that ministry and his advancement from a noncommissioned rank in the militia (Landwehr) to that of captain by a special imperial patent. Starting with the supervision of the chlorine project, both at home and at the front, he gradually emerged as the chief authority on all chemical warfare matters in Germany and received several high decorations, including the Iron Cross First Class, for his accomplishments in this field. The Allies, on the other hand, took a rather dim view of his activities. In 1919, shortly after Haber had been awarded the Nobel Prize for his prewar work on the synthesis of ammonia, his name was placed on an Allied list of Germans who were to be handed over for trial. Although proceedings against him were subsequently quashed, feeling over his role as the “inventor” of chemical warfare remained strong in some circles. When Haber left Germany after Hitler’s rise to power and was given an opportunity by Sir William Pope, of the Cavendish Laboratory, to continue his work at Cambridge, Ernest Rutherford, for instance, let it be known that he did not wish to meet Haber because of his wartime record.
Because of the still-existing bottlenecks in the German shell production program, Haber came up with the idea of releasing the chlorine from specially fitted containers in the German trenches and letting the wind push the gas into the opposing lines. Aside from the ready availability of industrial storage cylinders that could be adapted for that purpose, the “cloud gas” technique proposed by Haber offered the additional advantage that it could be used against those Allied positions which were too close to the German lines to permit their bombardment with high-explosive shells. The most serious drawback of the whole system, as the Germans soon found out, was of course its complete dependence on suitable wind conditions.

On December 18, shortly after testing of the new T-shells had commenced on the Kummersdorf artillery range, General von Falkenhayn got in touch with Emil Fischer, a renowned chemist at the University of Berlin. According to Fischer’s account of the meeting, Falkenhayn pointed out that the new Stinkstoffe were not altogether satisfactory in their effect, and that he wanted something which would incapacitate the enemy “permanently.” Fischer (who apparently had never been consulted before) thereupon replied that it was very difficult to develop chemical agents which would produce a lethal effect, though he subsequently confided to Duisberg that he actually knew of a substance that was “very bad” indeed. However, since the “necessary raw materials” for its production were not available in Germany, he, Fischer, thought it best not to pursue the matter, particularly since the enemy might get wind of it and use the idea to his own advantage.

About two weeks after Falkenhayn’s meeting with Fischer, the first experiments with chlorine discharges from cylinders were carried out on the Wahn artillery range. However, for security reasons, no “large-scale” test was attempted; as General Tappen later put it, one could hardly afford to have the smell of chlorine spread out for miles and miles. On the basis of the preliminary test results, the OHL decided in mid-January to clear the new weapon for use at the

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24 Emil Fischer to Carl Duisberg, December 20, 1914. (The text of this letter, from Fischer’s Nachlass, was kindly furnished by Prof. Gerald D. Feldman.)
25 See personal war diary, January 9, 1915, Tappen papers; Tappen to Wohlenberg, March 1922, ibid.; Tappen to Reichsarchiv (draft), March 19, 1927, ibid.
front, though its "unchivalrous nature," according to Tappen, was "initially repugnant" to everyone concerned.26

At the Hague Peace Conference of 1899, many nations, including Germany, had formally agreed to a number of rules and limitations in the conduct of war. Among other things, they had pledged not to "employ poison or poisoned weapons," or "arms, projectiles, or material calculated to cause unnecessary suffering," or to make "use of projectiles the sole object of which is the diffusion of asphyxiating or deleterious gases."27 By interpreting these clauses very literally, General von Falkenhayn and his advisers satisfied themselves that, quite apart from the "provocation" already offered by the French with their cartouches suffocantes, both the T-shells and the chlorine cloud gas were permissible weapons under the Hague Convention.28

As far as the prohibition of "poison or poisoned weapons" was concerned, the OHL took the position that this clause applied only to the deliberate poisoning of food or water, the use of missiles steeped in a poisonous substance, and the like, but that it clearly had no bearing on "gas" warfare, since the matter of "asphyxiating or deleterious gases" had been dealt with in an entirely separate agreement. The wording of that agreement, in turn, made it possible to maintain that the prohibition expressed therein did not apply to the particular gas weapons the OHL intended to use. The T-shells, at Falkenhayn's insistence, contained both a gas-producing compound and an explosive charge for fragmentation effect (hence they could be said to serve a dual purpose), while the release of chlorine gas from stationary cylinders did not involve "projectiles" at all. Finally, it could be and was argued that the new German gas weapons did not inflict "unnecessary" suffering on the enemy, since they were used solely to break, or at least reduce, his capacity for fight.29 Indeed, Haber both then and later took the position that

26 See Tappen to Reichsarchiv, July 16, 1930, ibid.; and RA, Weltkrieg, 8:38.
27 See the Annex to the Convention respecting the Laws and Customs of War on Land, article 23a, 23e; and the "Declaration concerning Asphyxiating Gases" of July 29, 1899. Britain and the United States did not sign the latter declaration, but Britain later, in 1907, formally "adhered" to it. See The Reports to the Hague Conferences of 1899 and 1907, ed. James B. Scott (Oxford, 1917), pp. 126 ff., 170 ff., 891, and passim.
28 See RA, Weltkrieg, 8:36–37; and Haber's postwar testimony in UA/Völkerrecht, 4:13.
gases were actually less cruel in their effect than high-explosive shells and other conventional weapons—a judgment which was eventually supported by many Western historians.30

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Because of various technical problems, more than three months were to elapse before the first chlorine cloud gas attack was actually carried out. The T-shells, on the other hand, were tried out at the front only a few weeks after testing had been completed.

The first contingent of T-shells, approximately 18,000 in all, was assigned to Colonel-General August von Mackensen’s Ninth Army on the Eastern front. After bitter fighting in central Poland during the late fall, Mackensen’s troops had been forced to dig in along the Bzura and Rawka Rivers, roughly halfway between Lodz and Warsaw. To screen Field Marshal von Hindenburg’s preparations for a major strike against the Russians in East Prussia,31 Mackensen was urged to stage diversionary attacks in his own sector and did so on a rather massive scale at the end of January. In the area near Bolimow, the attack by several of Mackensen’s divisions was preceded by an extensive bombardment of the Russian positions with the new T-shells, but the chemical irritant had little discernible effect on the enemy and the advancing German infantry quickly ran into fierce resistance. Only later was it realized that the volatility of the xylyl bromide had been severely reduced by the extreme cold at the time of the battle, a problem which really ought to have been foreseen by the chemical experts on the German side.32

As a result of the costly lesson learned at Bolimow, the chemical charge of the T-shells was subsequently changed to a mixture of xylyl bromide and bromoacetone, which seemed more suitable for cold-weather use.33 Some of these new shells were shortly thereafter


31 Hindenburg’s offensive, which began on February 7, led to the grim “Winter Battle of Masuria.”


33 See Hanslian, Der chemische Krieg, 1:57; and Carl Duisberg to Bauer, March 3, 1915, Bauer papers.
assigned to the Fourth Army, which, under the command of Duke Albrecht of Württemberg, held the Flanders sector of the Western front. It appears that the shells were first tried out there some time in March, particularly in the area near Nieuport, but the effect of the irritant gas seems to have been as minimal as it had been at Bolimow. One month later, the T-shells were used on a more massive scale during the German attacks in the Ypres region, though even then their impact appears to have been very limited.34

While the T-ammunition, upon its clearance by the OHL in mid-January 1915, was initially tried out against Russian troops, Falkenhayn and his advisers decided that the chlorine cloud gas system—code name “Disinfection”—should first be used on the Western front. According to later testimony by Gerhard Tappen, this choice was very much influenced by the OHL’s intention at that time to seek a “decision” in the West before long, but all available evidence points to the conclusion that such grand strategic considerations were quickly lost sight of. Indeed, it is obvious from subsequent events and Tappen’s own papers that the leading men at the OHL were doubtful from the start that the cloud gas system, requiring difficult and easily detectable preparations close to the enemy lines and depending completely on suitable weather conditions, could actually be used in a strategically decisive fashion.35

Having been assured by “the experts”—presumably Haber and other German chemists—that the Western Allies did not have the technical capability to respond very quickly with cloud gas discharges of their own, Falkenhayn and his advisers at the OHL between January 14 and 25 called in senior staff officers from various parts of the Western front (including the Verdun sector) to determine where the new weapon could best be used.36 In a conference with the chief of staff of the Fourth Army, Major-General Emil Ilse,37 and the commander of the Fifteenth Army Corps, General

34 See RA, Weltkrieg, 7:54; Hanslian, Der chemische Krieg, 1:15; “Denkschrift betreffend den Gaskampf . . . ,” p. 4, Bauer papers; and Edmonds et al. (n. 4 above), 1:184, 192, 198, and passim. A more “effective” German gas shell (which contained mono-chlor-methyl-chloroformate as the principal chemical agent) had been developed by April, but these so-called K-Granaten apparently did not become available for front-line use until the early summer. See RA, Weltkrieg, 9:394, n. 5; “Der Gaskrieg . . . ,” p. 5, Bauer papers; Carl Duisberg to Bauer, July 24, 1915, ibid.; and Geyer, “Der Gaskrieg,” p. 497.
36 See personal war diary, January 14, 25, 1915, Tappen papers; Tappen to Reichsarchiv, March 19, 1927, and July 20, 1930, ibid.
37 Unlike most other senior general staff officers who served as Chefs in the principal front-line Oberkommandos, Ilse was a heavy artillery specialist by
Berthold von Deimling, final agreement was reached that the chlorine cylinders would be assigned to the Fourth Army in Flanders and initially tried out in Deimling's corps area, that is, on the southeastern side of the Ypres salient.

To instal and operate the gas cylinders at the front, several special troop units were formed and placed under the command of an officer from the engineers corps, Colonel Peterson, while Haber took over the technical supervision of their work. Ultimately designated as the Pionierregiment 35, the new units were made up of regular combat engineers and a number of scientists who were recruited from other branches of the army or from civilian life. Among the newly recruited men were physicists James Franck and Gustav Hertz and chemist Otto Hahn (all future Nobel Prize winners), as well as several other scientists of great distinction. Hahn, according to his recently published memoirs, initially was very reluctant to become involved in a military activity which seemed to be violating the rules of the Hague Convention, but Haber pointed out to him that the French, through their use of gas-diffusing rifle grenades, had already begun to do just that, albeit in an "inefficient manner." Moreover, Haber emphasized, "countless lives would be saved if the war could be ended more quickly in this way."

Toward the end of February, Colonel Peterson's newly trained units began with the placement of chlorine cylinders in General von Deimling's corps area near the village of Gheluvelt. The difficult job of moving the heavy steel cylinders (code name "F batteries") into background. His keen interest in technological innovations may well have contributed to the OHL's decision to assign the new weapon to the Fourth Army. See Dr. Karl Heber, "Gasangriffe im 1. Weltkriege" (undated typescript), pp. 2 ff., Nachlass Friedrich von Tempelhoff [hereafter Tempelhoff papers], BA-MA; Tappen to Reichsarchiv, July 20, 1930, Tappen papers; and the biographical sketch of Ilse in Hanns Möller, Geschichte der Ritter des Ordens pour le mérite im Weltkrieg, 2 vols. (Berlin, 1935), 1:527-28.

38 A Badensian of bourgeois origin, Deimling in the course of his prewar career had acquired the reputation of being a particularly zealous "Prussian militarist"—notably at the time of the Zabern Affair. His attitude changed very drastically toward the end of the war; in contrast to most other generals, he became an active supporter of democratic and pacifist causes and later played a prominent role in the republican Reichsbanner organization.

39 See personal war diary, January 25, 1915, Tappen papers; and Berthold von Deimling, Aus der alten in die neue Zeit: Lebenserinnerungen (Berlin, 1930), p. 201.

40 See Hanslian, Der chemische Krieg, 1:16; and Hahn (n. 21 above), p. 118 and passim. Like Haber, Franck left Germany when Hitler came to power. He eventually continued his research in the United States, where, in 1945, he warned against a rash use of the atomic bomb ("Franck Report"). Hertz worked in the Soviet Union after World War II and received the Stalin Prize in 1951.

41 Hahn, pp. 117–18, 130. Hahn speaks of his being trained in the Pionierregiment 36, but this particular "gas regiment" actually was not formed until May. See RA, Weltkrieg, 8:133; and Heber, "Gasangriffe . . . ." p. 7, Tempelhoff papers.
the forward trenches and embedding them there under a layer of earth had to be done mostly at night and was not completed until about March 10. To everyone's consternation, wind conditions in the area during the next two weeks either proved clearly unsuitable for a release of the gas into the opposing, British-held, lines or changed just before a scheduled attack was to get under way. As a result, the German troops in the sector were placed repeatedly on fruitless alerts. To make matters worse, several cylinders were punctured by enemy shells or bullets, causing a growing number of gas casualties among the unprotected infantrymen in the German trenches.42

In view of the problems encountered in the Gheluvelt sector, Duke Albrecht of Württemberg and his advisers at Fourth Army headquarters decided on March 25 that an alternate "gas front" should be prepared on the northern side of the Ypres salient. While most of the chlorine cylinders eventually used for that new front seem to have come from newly delivered stock, there are indications that some F batteries were also taken from the contingent originally assigned to the Gheluvelt area. In any event, it is clear that because of continued adverse wind conditions no gas was actually released in Deimling's sector until the beginning of May, that is, a full two months after the cylinders had first been readied for action there.43

Both in Deimling's sector and later in the alternate gas front farther north, most German infantrymen, and their officers in particular, reacted to the arrival of the F batteries with distrust and displeasure. Their antipathy toward the eerie new weapon was soon heightened by occasional gas leakages from damaged cylinders in their own trenches and the additional work and danger to which they were subjected in assembling repeatedly for attacks which then had to be canceled because of adverse weather conditions.44 Misgivings about the new weapon were shared by several senior commanders in other parts of the Western front. Crown Prince Rupprecht of Bavaria, whose Sixth Army was deployed immediately to the south of Duke Albrecht's sector, told both Falkenhayn and Haber that the impending cloud gas attacks in the Ypres region seemed to him not only distasteful but also militarily unsound. If the technique proved effective, the enemy would certainly adopt it too, and since the

42 See RA, Weltkrieg, 7:55; Hanslian, Der chemische Krieg, 1:87; Deimling, p. 202; and Hahn, p. 118.
43 See RA, Weltkrieg, 7:63-64; and Deimling, pp. 202-4. Hahn, p. 119, claims that all chlorine cylinders in the Gheluvelt sector were moved to the northern gas front in mid-April, but this is obviously in error.
44 See Deimling, p. 202; "Der Gaskrieg . . .," p. 4, Bauer papers; and the detailed analysis in Heber, "Gasangriffe . . .," pp. 2 ff., Tempelhoff papers.
prevailing winds on the Western front came from the west, the Allies would be able to blow off gas “against us ten times more often than we could” against them.\textsuperscript{45} Despite Falkenhayn’s and Haber’s reassuring reply that the chemical industry of the Allies “was simply not capable of producing gas in the quantity needed,” Rupprecht’s concern did of course prove justified before long—by September the British were ready to stage a major cloud gas attack of their own, and Rupprecht’s Sixth Army was in fact the first to be hit.\textsuperscript{46}

Colonel-General Karl von Einem,\textsuperscript{47} who commanded the Third Army in the Champagne, was similarly unhappy about the introduction of the new weapon. “I fear it will produce a tremendous scandal in the world,” he wrote to his wife shortly after he had heard about the first gas attack at Ypres. Though the Allies “supposedly cannot imitate the device, I presume nonetheless that they will soon have something similarly diabolical. . . . War has nothing to do with chivalry any more. The higher civilization rises, the viler man becomes.”\textsuperscript{48} Two years later, after both sides had introduced ever more toxic gases on the battlefield, Einem would express himself even more strongly about Falkenhayn’s initiative in using such an “unchivalrous” weapon which was “repugnant to me from the very start.” “‘Now our enemies have it too, and many a good man on our side has died a hero’s death from poison.’”\textsuperscript{49}

On April 2, 1915—over four weeks after the first chlorine cylinders had been placed in the German trenches in the Gheluvelt sector—a large-scale test of the F batteries behind the front was at long last undertaken. In the course of the experiment, which was conducted on the Beverloo troop training grounds in eastern Bel-


\textsuperscript{46} “‘Now there we have got the reply to our chlorreichen [a pun on glorreichen (glorious)] attacks,’” was General Groener’s sarcastic reaction when he first heard about the British operation (personal diary, September 25, 1915, Nachlass Wilhelm Groener, BA-MA).

\textsuperscript{47} One of Falkenhayn’s predecessors as Prussian minister of war (1903–9).

\textsuperscript{48} Einem to his wife, April 23, 1915, Nachlass Karl von Einem gen. v. Rothmaler, BA-MA. Four days later, after hearing that the cloud gas had only “stupefied” the enemy, Einem agreed with the “very sensible proposal” by his chief of staff that the latter should visit the Fourth Army area to gain some experience with the new weapon. See Einem to his wife, April 24, 1915, ibid.; and Einem’s war diary, April 27, 1915, ibid.

\textsuperscript{49} Einem to his wife, February 1, 1917, ibid. Many other prominent German officers serving on the Western front were more ambivalent in their reactions. See, e.g., General Erich von Gündell: Aus seinen Tagebüchern, ed. Walther Obkircher (Hamburg, 1939), p. 169; and Albrecht von Thaer, Generalstabsdienst an der Front und in der O.H.L., ed. Siegfried Kaehler (Göttingen, 1959), p. 33.
gium, Bauer and Haber rode their horses too close to a drifting gas cloud and paid for their recklessness with near suffocation and several days of illness. Three days later, Colonel Peterson’s men started work on the alternate gas front north of Ypres. By April 11, over 5,500 gas cylinders had been moved into the forward trenches from a point near Steenstraat to the vicinity of Poelcappelle. Of the four German divisions holding this part of the front and the adjacent sectors on either side, two belonged to the Twenty-third Reserve Corps of General Hugo von Kathen, the other two to the Twenty-sixth Reserve Corps, which was headed by General Otto Freiherr von Hügel, a Württemberg officer who had been recalled to active duty at the beginning of the war. Both corps commanders, after witnessing the Beverloo test, were informed that the impending cloud gas discharges in their sectors were to be used for gaining ground on both sides of the Yser Canal, with the high ground near Pilckem serving as the prime objective for General von Hügel’s attack.

According to the official history prepared at the Reichsarchiv after the war, Fourth Army command assumed that with the capture of the Pilckem heights the positions of the Allies in the remainder of the Ypres salient would become untenable and Ypres itself would thus fall into German hands. However, there is considerable evidence that most of the principal figures involved in the operation did not expect very much more than a purely local success. To begin with, no major reserves were allocated for the operation; indeed, General Ilse initially turned down an offer of two regiments which the Naval Infantry Corps on the Channel coast was prepared to send down to Ypres for that purpose. Perhaps even more indicative of the limited objectives pursued by the Germans are General von Hügel’s instructions to his troops. On April 8, for instance, he notified his subordinates that the objective of the

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51 See RA, *Weltkrieg*, 7:64; Seesselberg (n. 23 above), p. 408; and personal diary, April 1–2, 1915, and subsequent undated entries, Hügel papers.


53 See ibid., 8:38–39 and n. 1; and the testimony of the Naval Infantry Corps’s (Marinekorps’s) chief of staff, Col. von Hülsen, in Hanslian, *Der deutsche Gasangriff bei Ypern*, pp. 93–94. General Ilse’s handling of the Ypres operation, including the belated and piecemeal use of the available Naval Infantry Corps units, subsequently caused some criticism in circles close to the kaiser, but no action was taken to remove him from his Chef position. See personal war diary, May 27, 1915, Nachlass Georg Alexander von Müller [hereafter Müller papers], BA-MA; and Col. Holland, A.O.K. 4, to Marchtaler, July 11, 1915, Nachlass Otto von Marchtaler, WHA.
impending operation was to seize the "ridge along the road Boezinge-Pilckem-Langemarck-Poelcappelle," following which all units were to "dig in immediately and establish mutually covering strong points." Eight days later, Hügel cautioned his two division commanders that the effect of the cloud gas might prove insufficient to get the German infantry to the Pilckem heights without great losses; if so, the attack was to be halted and everyone was to dig in until the enemy’s resistance had been softened up further by a bombardment with T-shells.

On April 10, that is, shortly before the placement of chlorine cylinders in the Steenstraat-Poelcappelle sector had been completed, Falkenhayn summoned General Ilse to his headquarters and impressed upon him that the gas attack should be carried out as soon as possible, since the Twenty-sixth Reserve Corps and several other units in the Ypres region might soon be needed elsewhere. Faced with this pressure from the OHL, Fourth Army command ordered that the gas attack be launched on April 15, but a complete lack of wind on the morning of that day once again, as in the Gheluvelt sector before, made it necessary to cancel the operation.

In view of the tense situation on the Eastern front, where the Austro-Hungarian ally was under mounting Russian pressure in the Carpathians, General von Falkenhayn had meanwhile arrived at a rather drastic change of plans. Whereas it had hitherto been intended to use Germany’s newly created strategic reserves either in France or in Belgium, he now decided to transfer at least eight divisions to Galicia for a major strike against the Russians in the Gorlice-Tarnow area. As a result of this shift of forces, which started on April 17, a new army—the Eleventh, with Mackensen in command and Colonel Hans von Seeckt as chief of staff—was formed on the Eastern front, while the German armies in the West were left with just enough strength to maintain their positions or, at most, to conduct local attacks here and there.

Although the chances for a strategically significant exploitation of a successful gas attack in the Ypres area thus became even more

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55 Order no. 4/16.4., to 51st and 52d Reserve-Divisionen and commander of the heavy artillery, April 16, 1915, ibid.
56 See personal war diary, April 10, 1915, Tappen papers; and RA, Weltkrieg, 7:64.
58 See personal war diary, April 17, 1915, Tappen papers; Tappen to Reichsarchiv, March 19, 1927, ibid.; and RA, Weltkrieg, 8:34-35.
remote than they had been previously, both Falkenhayn and Tappen insisted that the gas fronts prepared by the Fourth Army be activated as soon as possible. According to Falkenhayn’s memoirs, continued German activity along the Western front was necessary to screen the troop transfers to Galicia, and the Ypres operation was therefore quite useful. Moreover, according to Tappen’s testimony, it was felt that the hoped-for elimination of the Ypres salient was worthwhile in itself, in terms both of shortening the front and of seizing an area which had been fought over so “ardently” in the fall of 1914.

On April 21, one day after a second attempt to activate the gas front in the Steenstraat-Poelcappelle sector had had to be canceled because of a lack of wind, Falkenhayn and Tappen personally called on Duke Albrecht at his headquarters in Thielt. Both visitors made it clear to the Duke that the often-postponed gas attacks in the Ypres region were to be launched as soon as a “halfway favorable opportunity” presented itself, and that the objectives of the whole enterprise should not be set too high. Since weather conditions in the Steenstraat-Poelcappelle sector seemed to be improving, Fourth Army command thereupon scheduled the attack for the very next morning. As so often before, however, wind conditions early on April 22 proved clearly unsuitable, and the attack was eventually rescheduled for the late afternoon—despite serious reservations on the part of General von Káthen.

After weeks of anxious waiting by the Germans, during which period Allied military authorities had received, but largely ignored, several specific warnings about the new German weapon, the F batteries in the Steenstraat-Poelcappelle sector were finally activated about 5:00 P.M. local time (6:00 P.M. German time). Advancing

59 Falkenhayn (n. 14 above), p. 72. General Ludendorff at Oberost, long since a severe critic of Falkenhayn’s conduct of the war, promptly disagreed with that decision as well. See Ludendorff to Moltke, April 27, 1915, in Zechlin (n. 32 above), p. 339.

60 See Tappen to Reichsarchiv, March 19, 1927, and July 20, 1930, Tappen papers.

61 See personal war diary, April 21, 1915, ibid.; RA, Weltkrieg, 8:38; and Hanslian, Der chemische Krieg, 1:88.

behind the drifting gas clouds, the German infantry made rather uneven progress during the following hours. While the thrust in the center, toward the Pilckem heights and the Yser Canal between Het Sas and Boesinghe, succeeded very well, the advance on either wing ran into considerable resistance. The village of Langemarck, where whole regiments of young German volunteers had been decimated in futile attacks the previous fall, was taken by the Fifty-first Reserve Division of Hügel’s corps within an hour, but both in this area and during its subsequent advance toward Saint-Julien, the division was slowed down by flanking fire from Canadian troops in the adjacent sector and resistance from French units which had survived the gas attack with little or no harm. As a result, the Fifty-first Reserve Division did not catch up with its sister division on the right (the Fifty-second Reserve) until late in the evening, and the advance was subsequently halted. Shortly before midnight, General von Hügel issued instructions that the corps artillery be brought forward immediately and simultaneously advised his infantry to prepare their newly won positions for the ‘most tenacious defense.’ Farther to the west, in General von Kathen’s sector, too, the advance by the Forty-fifth and Forty-sixth Reserve Divisions was halted or bogged down late in the evening following the capture of some bridgeheads on the western bank of the Yser Canal and of the fiercely defended village of Steenstraat. The Allies thus gained precious time to recover from the initial shock and to rush their reserves into the area.

The effectiveness of the cloud gas in opening a hole in the French lines and the ensuing rapid advances by some of Hügel’s and Kathen’s troops initially produced considerable excitement at German general headquarters. The Kaiser, when he heard of the success the next day, embraced Falkenhayn three times and promised Colonel Tappen a bottle of pink champagne. His enthusiasm would probably have been less pronounced had he known that no sig-

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64 See RA, Weltkrieg, 8:39-41; and Hügel papers, personal diary, April 22, 1915. Cf. the eyewitness accounts in Hanslian, Der deutsche Gasangriff bei Ypern, pp. 87 ff., and in Das Ehrenbuch der Deutschen Pioniere, ed. Paul Heinrici (Berlin, 1932), pp. 565 ff.

65 ‘Korpsbefehl für den 23.4.15,’ issued at 11:50 p.m., April 22, 1915, Hügel papers.

66 See RA, Weltkrieg, 8:40-41.

significant reserves were left in the Ypres area to exploit the initial tactical success, and that all further offensive thrusts would have to be improvised.68

The lack of systematic planning became evident already on April 23. It was only late in the morning that specific directives concerning the continuation of the offensive were issued by Fourth Army command. While Hügel’s corps was instructed to push on southward toward Ypres, General von Kathen was given some reinforcements and told to advance “in the direction of” Poperinghe, a town west of Ypres which lay over ten kilometers behind the salient. Duke Albrecht’s and General Ilse’s apparent intention to send a major part of Kathen’s corps farther toward the west immediately aroused the misgivings of the OHL, and a hasty reminder was sent to the Fourth Army that for the time being the operation should be aimed solely at “pinching off” the remainder of the Ypres salient.69

But by now even this more modest goal could no longer be attained without a severe struggle, for Allied efforts to seal off the holes in their lines had already progressed too far and Allied counterattacks were mounting in strength. Although the German line of attack was progressively broadened toward the south during the following days, the whole operation quickly turned into a typical battle of attrition. A small-scale discharge of chlorine cloud gas early on April 24 against Canadian-held positions near Saint-Julien pushed back but failed to crush the defenders (who had meanwhile been issued makeshift respirators),70 and even though a series of further cloud gas discharges was staged in the early part of May, practically all further gains of ground by the Germans were achieved at an increasing cost to themselves. When the offensive in most parts of the salient finally ground to a halt in the second week of May, Ypres and its immediate environs were still in Allied hands and the German casualty rate had climbed to a total of over 35,000 men.71

Although the total losses of the British Empire troops and of the

68 See the report by Maj. Gen. von Magirus of the Württemberg war ministry on “Meine Reise auf den Kriegsschauplatz 22.4.-1.5.1915,” Nachlass Adolf von Magirus, WHA; personal war diary, April 23, 1915, Tappen papers; and personal war diary, April 23, 1915, Müller papers.

69 See RA, Weltkrieg, 8:41–43; the report by Magirus cited in n. 68 above; and Order no. 5/23.4., April 23, 1915, 5 p.m., Hügel papers.

70 I.e., cotton bandoliers which were to be wetted and tied over mouth and nose if a gas cloud approached. Other men saved themselves by applying a wet handkerchief to the face. See Nicholson (n. 2 above), pp. 71 ff.; and Macphail (n. 1 above), p. 299.

French and Belgian units in the Ypres region were even higher, and although the Allies' long-standing plans and preparations for a great "Spring Offensive" in Artois were seriously disrupted by the German onslaught in the Flanders sector, the "premature" disclosure of the cloud gas technique for such a "paltry prize" has often been interpreted as a major blunder on the part of the German high command. It is now clear, however, that General von Falkenhayn and his advisers at the OHL "wasted" the new weapon on a local operation with limited goals not so much because they were "scientifically hidebound" and muddleheaded, but because they had justifiable doubts that a large-scale offensive based on prior cloud gas discharges could actually be prepared with the necessary degree of secrecy. While it was difficult enough to conceal the installation of thousands of bulky gas cylinders in the forward German trenches, the leading men at the OHL were even more concerned about the likely prospect that the masses of troops needed for any kind of major offensive might have to wait in their jump-off positions for weeks on end before suitable wind conditions for a cloud gas discharge materialized. It was this specter of perpetual delays, and the attendant risk that the enemy would discover the buildup of forces against him, which induced Falkenhayn and his staff in mid-April to prepare the great German-Austrian strike against the Russians in the Gorlice-Tarnow area with conventional weapons only—a decision which would be fully vindicated by the smashing success of that offensive early the next month.

74 See Tappen to Reichsarchiv, March 19, 1927, Tappen papers.
75 See ibid.; and RA, Weltkrieg, 7:360–63, 367 ff.
76 About five days before Mackensen's offensive started, the OHL actually changed its mind and dispatched a battalion of gas troops to the Gorlice area. However, both the men and their equipment arrived there much too late to serve any useful purpose. In mid-May, the battalion was therefore reassigned to the Ninth Army in central Poland, where, together with other units, it subsequently prepared a major gas front (with 12,000 cylinders) in the area northeast of Bolimow. That front was activated on May 31—exactly four months after the first T-shell attack had been staged against the Russians in the very same region. See Heber, "Gasangriffe . . . ," pp. 7–9, Tempelhoff papers; Hahn (n. 21 above), p. 119; RA, Weltkrieg, 8:133–35; and Hanslian, Der chemische Krieg, 1:17, 100. Both Erich Ludendorff, Meine Kriegserinnerungen (Berlin, 1919), pp. 109–10, and Hoffmann's Aufzeichnungen (n. 32 above), 2:107–8, list May 2 as the date of the first cloud gas attack by the Ninth Army, but this is obviously in error.
As for the traditional commemoration of April 22, 1915, as the birthday of modern chemical warfare, that designation is obviously quite misleading. Attempts to break the resistance of enemy soldiers by chemical “irritants” had been made on both the Eastern and Western fronts long before that day. What happened at Ypres was thus not an abrupt departure from all existing norms and practices but rather the escalation of a combat technique which had been used before, albeit ineffectually. The “success” of the German gas attack at Ypres, it should be emphasized, was only in part attributable to the fact that chlorine gas was more harmful in its effect on the human organism than the irritant vapors previously tried by Germans and French alike. Far more important was the quantitative dimension of the operation, that is, the enormous volume of gas that was effectively diffused on that day. In fact, it was above all the high concentration of gas over a wide area (something which the French had never tried and the Germans had never achieved before) which made the attack of April 22 militarily “effective”—in terms both of incapacitating a large number of enemy soldiers and of killing some of them for good measure.77 In the course of the next three years, Germans and Allies alike were to introduce ever more toxic chemical agents on the battlefield and to use them on a truly gigantic scale; but thanks to the rapid development and continuous improvement of face masks and other protective devices, only a few gas attacks of this later period would have quite the same impact as the one that opened the “Second Battle of Ypres.”78

77 While the German chemical warfare experts were well aware that chlorine gas could be made even more “effective” by mixing it with phosgene, the use of that highly toxic pulmonary irritant was initially deemed too provocative, and the Ypres cloud gas discharges on April 22 and 24 were therefore staged with chlorine only. This restraint, however, was soon abandoned. In the first cylinder attack on the Russian front, on May 31, a phosgene “supplement” (Zusatz) of “about 5 percent” was used along with the chlorine, and the death rate in the gassed Russian trenches was accordingly much higher. See Heber, “Gasangriffe . . . ,” pp. 2–9, Tempelhoff papers; Hanslian, Der deutsche Gasangriff bei Ypern, p. 70; idem, Der chemische Krieg, 1:100; and RA, Weltkrieg, 8:135, n. 1.

78 For an introduction to the extensive monographic literature on these subjects, see especially Hanslian, Der chemische Krieg. Useful statistical assessments of the gas casualties on both sides may be found in Harry L. Gilchrist, A Comparative Study of World War Casualties from Gas and Other Weapons (Washington, D.C., 1928); and in the Handbuch der neuzzeitlichen Wehrwissenschaften, ed. Hermann Franke, 3 vols. (Berlin, 1936–39), 1:104.