From Military to Civilian Technology: The Introduction of Tear Gas for Civil Riot Control

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Mobs commanded significant power in the civil disorders, race riots, and violent labor disputes which erupted following World War I.[1] In 1921 a new weapon, tear gas, first was demonstrated to police forces and subsequently was adopted by them for civil riot control. Tear gas munitions were part of the arsenal of new chemical weapons developed by American chemists during World War I for use on the battlefields of Europe. The fact that they were made available to police forces rather than remaining in the hands of the Army meant that tear gas could be used on civilians in the cities of the United States without calling for the intervention of federal troops. The circumstances surrounding the transfer of this weapon from the military to local police forces are the subject of this study. Factors in the transfer included instances of military rivalry, changing attitudes of government leaders toward chemical warfare, the enterprise of several individuals in starting companies to supply tear gas munitions to police departments, and the support given these firms by the Chemical Warfare Service of the United States Army.

Wartime Development of Tear Gas

The lachrymatory (tear-producing) properties of many chemical compounds had been noticed for decades prior to World War I.[2] It

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[1]Accounts of the major riots include William M. Tuttle, Jr., *Race Riot: Chicago in the Red Summer of 1919* (New York, 1970); Interchurch World Movement of North America, *Report on the Steel Strike of 1919* (New York, 1920); and Bennett Milton Rich, *The Presidents and Civil Disorder* (Washington, D.C., 1941). For a description of riot guns and police tactics for control of mobs prior to the introduction of tear gas, see Cornelius Francis Cahalane, *The Policeman* (New York, 1923), and Henry A. Bellows, *Manual for Local Defense* (New York, 1918).

[2]A review of this literature is given in Kirby E. Jackson and Margaret A. Jackson, "Lachrymators," *Chemical Reviews* 16 (1935): 195–242.

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was only during the war, however, that a systematic study of lachrymatory substances was undertaken, and an effective means of dispersing these agents was developed as part of the intense programs of chemical warfare research conducted by each of the major powers.[3] Available evidence suggests that the French were responsible for the introduction of tear gases into the war. Their use of tear gas in 1914 figured in the debate on the question of which country initiated chemical warfare. After the war, several German authors called attention to the facts that cartridges containing a lachrymatory substance, ethyl bromoacetate, had been used even before the war by the Paris police and that the French Army had used similar shells and grenades as early as August 1914, eight months prior to the first chlorine gas attack at Ypres.[4] Indeed, the Paris police had used such cartridges in the capture of a barricaded criminal in March 1913.[5] It is also generally agreed that the French employed lachrymatory grenades containing ethyl bromoacetate and chloroacetone and the Germans used grenades containing xylyl bromide prior to the famous Ypres attack.[6] Tear gas munitions were therefore the first agents of chemical warfare to be used in World War I, and they subsequently played a significant role in the war. An important tactic in the fighting was to force the opposing army to wear gas masks as much as possible, since it was learned that soldiers lost much of their efficiency after wearing these uncomfortable masks for any extended period of time. Tear gases, being effective in much lower concentration than the toxic gases, were therefore considerably more economical in achieving this objective and consequently were widely used at the front.

The research conducted on tear gases in 1917 and 1918 by the United States Bureau of Mines and the Research Division of the Chemical Warfare Service, United States Army, resulted in the development of the powerful new tear gas chloroacetophenone. Although

[3]The history of the research on all types of chemical warfare conducted in the United States during World War I is given in Daniel P. Jones, *The Role of Chemists in Research on War Gases in the United States during World War I* (Ph.D. diss., University of Wisconsin, 1969; University Microfilm no. 69-22406, Ann Arbor, Mich. 1971).

[4]The use of tear gas cartridges by the Paris police was reported by an American, Clarence J. West, in "The History of Poison Gases," *Science* 49 (1919): 415. This statement was subsequently cited by two German authors, Rudolph Hanslian and Fr. Bergendorff, in *Der chemische Krieg* (Berlin, 1925), p. 9; and Curt Wachtel in *Chemical Warfare* (New York, 1941), p. 31. Supporting evidence was given by Fritz Haber, in *Fünf Vorträge aus den Jahren 1920–1923* (Berlin, 1924), pp. 82–83.

[5]*Times* (London) (March 25, 1913).

[6]Stockholm International Peace Research Institute, *The Rise of CB Weapons* (New York, 1971), pp. 129–32; and Frederic J. Brown, *Chemical Warfare: A Study in Restraints* (Princeton, N.J., 1968), pp. 6–7.

quantities of this agent were not ready in time to be used during the war, chloroacetophenone was later adopted as the standard tear gas for police use in the United States. Initially, the tear gas chosen in the spring of 1917 for use by the American Expeditionary forces was brombenzyl cyanide, an agent that had been used successfully by the French. A plant for its manufacture, constructed at Kingsport, Tennessee, began operation on October 29, 1918. Although this plant had a capacity of 3 tons per day, it had produced only 5 tons before the war ended.[7] In the spring of 1918, chemists of the Research Division learned that chloroacetophenone possessed properties that made it preferable to brombenzyl cyanide, and when the war ended the development of chloroacetophenone as the primary tear gas for the Army was well under way.[8] Since only small quantities were produced during the war for experimental purposes, few people knew of chloroacetophenone, and for several years the Chemical Warfare Service (CWS) maintained a degree of silence concerning this powerful lachrymatory agent it had developed.[9]

Chloroacetophenone was prepared first by the German chemist Graebe in 1871 and its lachrymatory properties noted.[10] In May 1917, a sample of this compound was prepared by E. Emmet Reid, an organic chemist at the Johns Hopkins University, in order to assess its value as a tear gas. At that time, Reid was conducting a search for possible new war gases among the toxic and lachrymatory compounds reported in the chemical literature. He had volunteered for war gas research as a consultant to the Bureau of Mines, the agency responsible for chemical warfare research in the United States from April 1917 until July 1918, when the Army took control.[11] Reid took his sample of chloroacetophenone to the Bureau of Mines office in Washington so that its effectiveness as a lachrymator could be determined by physiologists working under the bureau's direction.

[7]U.S. War Department, *America's Munitions, 1917–1918* (Washington, D.C., 1919), p. 405. Memorandum, Amos A. Fries, August 13, 1919, Correspondence of the Chief of the Chemical Warfare Service, 1918–42, Records of the Chemical Warfare Service, Record Group 175, entry 1, National Archives, Washington, D.C. (Records in this collection are hereafter cited as Correspondence, Chief CWS.)

[8]E. Emmet Reid, "History of Offense Research, Johns Hopkins University Station," Historical Reports, CWS, H-149, pp. 10–12, Technical Library, Edgewood Arsenal, Aberdeen Proving Grounds, Maryland; and "Reminiscences of World War I," *Armed Forces Chemical Journal* 9 (July–August 1955): 37–39.

[9]Amos A. Fries to Marston T. Bogert, December 24, 1920, Correspondence, Chief CWS.

[10]Carl Graebe, "Ueber eine neue Klasse von Alkoholen," *Berichte* 4 (1871): 34–35.

[11]For an account of the Bureau of Mines research, see Van H. Manning, *War Gas Investigations,* U.S. Bureau of Mines Bulletin no. 178-A (Washington, D.C., 1919), and Jones, pp. 89–165.

However, it was eight months before an adequate testing apparatus for lachrymators was constructed, and the preliminary report indicating the value of chloroacetophenone was not issued until March 11, 1918. Subsequent reports showed that chloroacetophenone was as effective as brombenzyl cyanide and had several advantages.[12] It did not react with shell casings, and it did not require bromine, which at the time was in short supply, for its manufacture, as did brombenzyl cyanide. The decision was made to proceed with the development of chloroacetophenone at a conference of the Offense Research Section of the Research Division held on April 11, 1918. Detailed studies of the synthesis of chloroacetophenone were undertaken by Reid at the branch laboratory of the Bureau of Mines established at Johns Hopkins and by Roger Adams at the bureau's American University Experiment Station.[13] The design of a manufacturing process proved difficult, but eventually a small-scale plant was constructed at American University following a method adapted by Reid from that described by Friedel and Crafts in 1884.[14] Production was halted just prior to the Armistice by a fire which destroyed the plant.[15] The Chemical Warfare Service possessed only a limited supply of chloroacetophenone from this time until a large-scale plant for its manufacture was completed at Edgewood Arsenal in 1922.[16]

Tear Gas Prohibited, 1919–21

In the two years following the Armistice, the United States was the scene of twenty-nine violent strikes and major riots which required federal troops to restore order.[17] At this time, it is not surprising that veterans of the European fighting would consider tear gas as an alternative to the use of clubs and firearms for the control of such mobs.[18] The director of the Chemical Warfare Service soon received

[12]Clarence J. West, *Pharmacological Data,* Chemical Warfare Monographs (hereafter CWM), no. 50, p. 53, Technical Library, Edgewood Arsenal. The many reports are summarized in Clarence J. West, *Chloroacetophenone,* CWM no. 32.

[13]Lauder W. Jones, *Offense Chemical Research Section, Summary of Achievement, 1917–1918,* CWM no. 54, pp. 38–39.

[14]C. Friedel and J. M. Crafts, "Sur une nouvelle méthode générale de synthèse des combinaisons aromatiques," *Annales de chimie et le physique,* 6^{e} série, 1 (1884): 507–8.

[15]George A. Burrell to Director, CWS, November 5, 1918, Correspondence, Chief CWS.

[16]Amos A. Fries to William L. Sibert, July 29, 1919, ibid.; and Leo P. Brophy, Wyndham D. Miles, and Rexmond C. Cochrane, *The Chemical Warfare Service: From Laboratory to Field* (Washington, D.C., 1959), p. 70.

[17]Marlin S. Reichley, "Federal Military Intervention in Civil Disturbances," (Ph.D. diss., Georgetown University, 1939), pp. 192–95.

[18]See, e.g., a letter to the editor in the *New York Times* (July 31, 1919).

inquiries about the availability of tear gas munitions, the first of which came on August 16, 1919, from A. D. Porter of the New York Police Department.

> I am writing you on the subject of the use of tear gases in connection with crowds of strikers and disorderly persons on the street during the time of riot or other such disturbances. It has occurred to me these gases might be an efficient agency in suppressing disorder.
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> Will you please be good enough to advise your opinion on the subject—i.e. as to whether it would be practicable, whether there would likely be any serious or lasting results to the people gased, and whether in your opinion public opinion would tolerate the use of it? Any information you can give me on the subject will be very much appreciated.[19]

In his reply, Major General William L. Sibert explained that he believed tear gas would be a very good method of dispersing mobs and that the CWS was in fact developing special tear gas grenades for this purpose.[20] Indeed, the CWS had been considering such munitions for several months prior to Porter's letter. In testimony before the U.S. Senate, Lieutenant Colonel Amos A. Fries, then commander of Edgewood Arsenal and later Sibert's successor as chief of the CWS, had included among the peacetime functions of the CWS the use of tear gas for "police work" in the Philippines and in Central America.[21] The task of developing a tear gas grenade with a nonfragmenting celluloid and paper body was assigned to a group at Edgewood Arsenal headed by Captain W. J. Taylor. Successful field tests of the grenade were conducted in late September 1919.[22] These results prompted Fries to include a section on mob control in foreign countries as part of an article he wrote that same month for the periodical *Chemical Warfare,* in which he predicted that "gas will be equally as effective in smoking out the desperado, who, occasionally in our own country runs amuck and then barricades himself with firearms and ammunition in some house or barn and for days bids defiance to the world."[23]

The first opportunity to try the new grenades came that same

[19]A. D. Porter to William L. Sibert, August 16, 1919, Correspondence, Chief CWS.

[20]Sibert to Porter, August 20, 1919, ibid.

[21]U.S. Congress, Senate, *Hearings on H.R. 5227, An Act Making Appropriations for the Support of the Army for the Fiscal Year Ending June 30, 1920,* 66th Cong., 1st sess., June 18, 1919, p. 291.

[22]Memorandum, W. J. Taylor to Amos A. Fries, August 22, 1919, Correspondence, Chief CWS.

[23]Amos A. Fries, "The Humanity of Poison Gas," *Chemical Warfare* 1 (November 6, 1919): 6.

month, when the riots and looting mobs accompanying the Boston police strike prompted a telegram from the district chemical officer which read, "Referring Boston riots suggest consideration furnishing lachrymatory grenades if any available. Besides quelling riots they would demonstrate value chemical warfare."[24] Within a week, another request arrived from the director of the Department of Public Safety, Norfolk, Virginia, who commented, "In this city, where it is possible that we may have a great deal of trouble with the negro element, such a device, I believe, would work to perfection."[25] In reply to these two inquiries, the CWS stated that, although the grenades were nearly perfected, the War Department might not authorize their use.[26] The attitude of the War Department proved to be as predicted, for in November, when the celluloid tear gas grenades were ready, the CWS was instructed not to issue them for use in civil disturbances. This ruling followed a request for tear gas from General Leonard Wood, commander of troops enforcing martial law in Gary, Indiana, during the steel strike. General Sibert forwarded the request to the chief of staff because "the use of chemical grenades for riot duty is a question of War Department policy, and for this reason issue has been withheld and the requisition submitted for approval."[27] He added his own recommendation: "It is noted on the attached requisition that the Ordnance Department has issued the item of high explosive hand grenades called for. It is believed that the chemical grenades requested are far more humane and suitable for quelling riots and dispersing mobs than either high explosive grenades or bullets, as the nonpoisonous chemical grenades only temporarily incapacitate and do no permanent injury."[28] Despite the fact that the CWS had developed a suitable tear gas grenade and was eager to provide it for mob control, the War Department refused permission for such munitions to be issued to federal troops or to police forces. This policy was communicated in a confidential telegram dated November 7, 1919, to the commanding generals of all departments from the adjutant general of the army, indicating that the secretary of war, Newton D. Baker, did not desire the use of any chemical material against mobs composed of inhabitants of the United States.[29] This policy did not

[24]Telegram, E. N. Johnston to William L. Sibert, September 12, 1919, Correspondence, Chief CWS.

[25]A. C. Dillingham to William L. Sibert, September 17, 1919, ibid.

[26]Amos A. Fries to A. C. Dillingham, September 20, 1919, ibid.

[27]Memorandum, William L. Sibert to Chief of Staff, November 3, 1919, ibid.

[28]Ibid.

[29]The telegram of November 7, 1919, is referred to in a memorandum, Amos A. Fries to William L. Sibert, February 16, 1920, and in a letter, L. M. McBride to Chief of Chemical Warfare Service, September 3, 1921, ibid. A comprehensive prohibition of all

change officially until September 1921, despite many additional requests forwarded by the CWS. Representative of the position of the CWS during these months is the reply of Fries, who had succeeded Sibert as chief of the CWS, to a request that 100 tear gas grenades be issued to the New York National Guard.

> Replying to your letter of September 16th you are advised that there have been a number of requests and considerable correspondence with both New York and other city authorities concerning the possible use of tear gas bombs in handling mobs. This office also took up the development of a combined hand and rifle grenade for that purpose. A non-splintering grenade of that type was developed several months ago. Its use or the use of any other chemical grenade has consistently been refused by the War Department.
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> There is no doubt in the minds of the Chemical Warfare Service but what tear or other irritating gas grenades can be used that will be practically harmless except for temporary blindness due to copious tears. It is not believed that any mob will continue its operations once it begins to weep so that it cannot see. However, any further action by this office is impossible until the attitude of the War Department changes.[30]

From tests of the new grenade, Fries concluded that tear gas could have been used effectively during the Boston police strike, the Gary steel strike, and other violent disorders of late 1919 and 1920. Indeed, when tear gas subsequently was used by federal troops to disperse mobs, it did so easily and with a minimum of bloodshed. For example, in 1932, federal troops successfully used tear gas to disperse the Bonus Army after their occupation of several buildings in Washington, D.C.[31]

Not only was the War Department opposed to the CWS using tear gas on civilians in 1919, but at this time it was trying to disband the CWS. The policy of the War Department in opposing the use of tear gas can be attributed largely to the hostility that had developed between the regular Army and the Chemical Warfare Service over the future of the CWS in peacetime, an issue which was before Congress in 1919 and 1920.[32] The military personnel of the CWS at the end of

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chemical warfare munitions is in a telegram, Ralph Harrison, Adjutant General, for the Secretary of War, to Director, CWS, November 29, 1919, ibid.

[30]Amos A. Fries to J. McI. Carter, September 21, 1920, ibid.

[31]*New York Times* (July 29, 1932).

[32]For a discussion of how United States policy on chemical warfare was influenced by this debate, see Brown (n. 6 above), pp. 72–93.

the war had been 1,680 officers and 18,838 enlisted men; seven months later there remained only 328 officers and 261 enlisted men, less than 3 percent of the wartime strength.[33] This rapid demobilization alarmed the chemists of the country, who had formed an allegiance to the CWS during the war, and Charles Herty, of the American Chemical Society, referred to this action of the War Department as "one of the quickest operations of the war."[34] Although demobilization of Army units was common in the months following the war, it soon became apparent that the CWS was marked for extinction by the secretary of war. The general order of July 1, 1918, which had established the CWS as a division of the War Department, had provided for the disbanding of the CWS six months after the termination of hostilities, and Secretary of War Newton D. Baker and Army Chief of Staff Peyton C. March were opposed to any continuation of the CWS as a permanent body.[35] In his testimony at Senate hearings on the Army Reorganization Bill, March showed some distrust of the increasing role of science and technology in the military and explained that "the theory of the War Department is this: that instead of having a corps called the Chemical Warfare Service, which must necessarily, in time of peace, be a student organization of college professors and scientists, that it be placed under the Engineering Corps."[36] Ultimately, officers of the CWS were able to convince influential congressmen that a state of preparedness for chemical warfare had to be maintained in the event another enemy instigated its use. According to the terms of the National Defense Act, which became law on June 4, 1920, the CWS was established as a permanent part of the Army, on a level with the Infantry, Artillery, and Air Corps.[37]

In promoting its own cause in Congress, the CWS needed to demonstrate its usefulness in peacetime, and one area of chemical warfare

[33]U.S. War Department, *Report of the Disorder of the Chemical Warfare Service, 1919* (Washington, D.C., 1920), p. 15.

[34]Charles H. Herty, *The Reserves of the Chemical Warfare Service,* National Research Council Reprint and Circular Series no. 16 (Washington, D.C., 1921), p. 2. The allegiance of the chemists of the United States to the CWS was discussed and the reasons for their support of the CWS in 1919 were analyzed in Jones, *Role of Chemists* (n. 3 above), pp. 166–97. Many of these points appeared later in Gilbert F. Whittemore, Jr., "World War I, Poison Gas Research, and the Ideals of American Chemists," *Social Studies of Science* 5 (1975): 135–63.

[35]Possible reasons for their resentment toward chemical warfare are examined by Brown, pp. 33–48.

[36]U.S. Congress, Senate, *Hearings on S. 2715, A Bill to Reorganize and Increase the Efficiency of the United States Army and for Other Purposes,* 66 Cong., 1st sess., 1919–20, 1:94.

[37]*H.R. 12775,* 66th Cong., 2d sess., 1920.

expertise was tear gas. From the standpoint of the CWS, the ability to use tear gas to control effectively the current civil disorders would demonstrate the value of their research program, might provide the CWS with the function of training police forces to use tear gas, and probably would dispel the public's fear and revulsion of gas warfare, which had caused some resentment of the CWS. On the other hand, realizing these advantages to the CWS, the War Department's interests were best served by a policy forbidding the use of tear gas, and adverse public opinion provided a suitable excuse for their attitude. This view is convincing when it is noted that this policy was only one of the many restrictions placed on the CWS at this time by the War Department. In a memorandum on the state of the CWS issued in December 1920, Fries listed several decisions of the War Department during the preceding six months that had limited the activities of the CWS by eliminating all training activities and demonstrations with chemical munitions.[38]

Tear Gas Approved, 1921–23

The restrictive policy of the War Department remained in force until a new secretary of war and chief of staff were appointed.[39] Upon assuming office in March 1921, Warren G. Harding appointed John W. Weeks secretary of war, and on July 1, 1921, John J. Pershing replaced March as chief of staff. Pershing had become familiar with chemical warfare as commander of the American Expeditionary Force, and moreover he had appointed Fries head of the Gas Service and had served with him in France. Six months prior to Pershing's appointment as chief of staff, Fries had arranged a conference with him at which he had explained the many needs of the CWS.[40] Fries had reason to expect better treatment of the CWS after Pershing became chief of staff, and he formally requested sweeping changes in War Department policy toward chemical warfare in a letter to Pershing dated July 26, 1921.[41]

Anticipating a relaxation of the ban on tear gas, Fries arranged for a demonstration of tear gas grenades to the police departments of Philadelphia and New York through a former officer of the CWS,

[38]Memorandum, Amos A. Fries to the Secretary of War, December 13, 1920, Correspondence, Chief CWS.

[39]The War Department restriction on tear gas was still in effect on June 20, 1921, when Fries replied to a request for tear gas from the police of Savannah, Georgia (Fries to F. I. Gibson, June 20, 1921, ibid.).

[40]The topic of their conversation is referred to in a letter, Amos A. Fries to J. J. Pershing, January 4, 1921, John J. Pershing Papers, Library of Congress, Washington, D.C.

[41]Amos A. Fries to Chief of Staff, July 26, 1921, Correspondence, Chief CWS.

Stephen J. DeLanoy. DeLanoy had served under Fries as second in command of Edgewood Arsenal at the time that the civilian tear gas grenade had been developed and tested there. Subsequently, he was assigned as CWS officer in New York, and he had left the service soon thereafter.[42] On July 6, 1921, Fries instructed the commander of Edgewood Arsenal to allow DeLanoy to interview Donald B. Bradner and other researchers engaged in the civilian grenade project "so that whatever he undertakes to do will be undertaken in the light of the best knowledge up to date. It is important to us as it is to the country at large that no mistakes be made in such a demonstration." Fries further instructed that DeLanoy be given any materials he needed for the demonstration, and accordingly, on July 12, 100 tear gas grenades were sent to him from Edgewood Arsenal.[43]

DeLanoy staged the demonstration in Philadelphia on July 19 and in New York on July 22.[44] Accounts of these tests were carried in the *New York Times,* and an article was published in *Scientific American* which described the grenade and its effectiveness.[45] The *Times* account of the first demonstration was as follows:

> Philadelphia, July 19, 1921.—The effectiveness of tear gas as a mob dispeller received the emphatic endorsement of 200 stalwart Philadelphia policemen today after the gas had thrice sent them into hasty and wet-eyed retreat during an official test here.
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> Police Supt. Mills took a battalion of his huskiest men into a roped-off enclosure with instructions to capture six men who were armed with 150 tear gas bombs. Three times they charged, but each time were driven back, weeping violently as they came within range of the charged vapor. Major Stephen DeLanoy of the Chemical Warfare Divsion, United States Army, inventor of the gas, assured the men before they entered the mimic battle that the substance was "absolutely not dangerous." "It is merely a tear-producing, choking, nauseating gas," he said, "But be careful you don't swallow too much."
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> Police officials said [that] the test had undoubtedly proved the value of tear gas in police work. Not only is it immediately effective in dispersing a mob, but it might be used to drive a

[42]Records of Headquarters, Records of CWS, Record Group 175, entry 6, National Archives. DeLanoy had spoken of the research on the celluloid tear gas grenade to visitors at Edgewood Arsenal in 1919. Leslie T. Sutherland to Commanding Officer, Edgewood Arsenal, August 10, 1919, Correspondence, Chief CWS.

[43]Amos A. Fries to Major E. J. Atkisson, July 6, 1921; Memorandum, E. J. Atkisson to Chief, Chemical Warfare Service, July 12, 1921, Correspondence, Chief CWS.

[44]*New York Times* (July 20, 1921) and (July 23, 1921).

[45]William A. McGarry, "Philadelphia's Tear Bombs and Mobs," *Scientific American* 125 (1921): 197.

> fugitive from a barricaded building, they said. . . . Officials asserted it was likely the gas would replace means hitherto used to subdue mobs and criminals.[46]

On August 6, 1921, DeLanoy reported the results to Fries under his new letterhead, "Stephen J. DeLanoy, Chemical Protection, 20 North Westfield Avenue, Trenton, New Jersey": "In the tests held it was shown that gas intelligently used, was not only a most effective, but a most humane method of dispersing rioters, mobs or other unlawful elements, and in the protection of property from the wanton acts of such." DeLanoy explained that the Philadelphia police had agreed to adopt tear gas and had accepted his offer to train officers in its use. He pointed out that "it should also tend to help the Service, as each city that I establish training courses in will mean added publicity to the use of the gas, and will also be the means of bringing home to, and causing the general public to more clearly understand the importance and power of gas as a weapon of modern warfare." He closed with the comment, "I am very glad to hear of the bright prospects for the Service under the present administration, and feel that with General Pershing as Chief of Staff, the Service will be given the place and importance in the administration of the Army it deserves."[47]

At DeLanoy's request, Fries wrote a letter to the superintendent of the Philadelphia Police Department, commending his decision to train his men in the use of tear gas and stating, "I am greatly pleased to see your interest in this matter and that you were first to carry out the real tests of the value of these gases."[48] Later that month, Fries ordered the commanding officer of Edgewood Arsenal to provide DeLanoy with additional tear gas grenades, as well as 25 pounds of chloroacetophenone for the training course.[49] During the next few months, DeLanoy continued his reports to Fries on the progress of his efforts to interest police departments in tear gas equipment, knowing "that it is his [Fries's] desire that they be equipped and efficiently trained."[50] He also suggested some modification in the design of the grenade, based on the field trials he had conducted.

Meanwhile, an even greater opportunity presented itself for the CWS to show the effectiveness of tear gas for mob control. On August

[46]*New York Times* (July 20, 1921).

[47]S. J. Delanoy to Amos A. Fries, August 6, 1921, Correspondence, Chief CWS.

[48]Amos A. Fries to W. B. Mills, August 9, 1921, ibid.

[49]Memorandum, Amos A. Fries to Commanding Officer, Edgewood Arsenal, August 26, 1921, ibid.

[50]Stephen J. DeLanoy to Amos A. Fries, September 2, 1921, ibid.

25, 1921, the governor of West Virginia requested federal troops to help restore order in Mingo County, where a continuing strike by coal miners had erupted into violence.[51] Pershing acted promptly in contacting Fries, who provided the General Staff with a summary of the nontoxic chemical agents which were available for control of the unruly miners in West Virginia.[52] Fries ordered that a detachment of chemical troops from Edgewood Arsenal be ready for duty and a supply of tear gas munitions be prepared for shipment within twenty-four hours.[53] The War Department thereupon rescinded the order prohibiting the use of chemical warfare agents on mobs as far as nontoxic gases were concerned and instructed the adjutant general on September 1 to notify all commanders of this change in policy. This was done in a letter dated September 7, 1921.[54]

In response to a second request from the governor, Harding signed a proclamation of martial law for five counties in the mining region, but he withheld its issuance in hope that the miners and others who had joined the fighting would voluntarily disarm themselves. However, the threat of violence continued, and the decision was made to send federal troops into Logan and Mingo Counties. On September 2, nearly 1,500 men were sent from various army camps in Ohio, Kentucky, and New Jersey.[55] In addition, the War Department ordered a detachment of twenty-eight officers and men from the First Gas Regiment at Edgewood Arsenal to proceed to Charleston, West Virginia, for duty.[56] On September 3, a train arrived carrying the detachment and a large supply of tear gas munitions, including 1,000 chloroacetophenone grenades, 350 mortar shells filled with chloroacetophenone, 190 lachrymatory candles, smoke candles, and grenades, as well as standard rifle and pistol ammunition. In addition, 191 aerial-drop bombs were filled with chloroacetophenone at Edgewood Arsenal and shipped separately to the 88th Aerial Squadron on duty at Charleston. Before shipment, these bombs were tested

[51]*New York Times* (August 26, 1921).

[52]Memorandum, Amos A. Fries to Chief, Operations Division, General Staff, August 31, 1921, Correspondence, Chief CWS.

[53]Memorandum, A. Gibson to Commanding Officer, Edgewood Arsenal, August 26, 1921, ibid.

[54]The order of September 1, 1921, is referred to in a letter, C. E. Brigham, Chief of Administration, CWS, to Lewis M. McBride, September 9, 1921; receipt of the subsequent written policy of September 7 is referred to in a letter, H. R. Lebkicher to Chief, Chemical Warfare Service, September 24, 1921.

[55]U.S. War Department, *Annual Report of the Secretary of War, 1922* (Washington, D.C., 1922), pp. 204–5.

[56]Chemical Warfare Service, Special Orders no. 244, September 2, 1921, par. 6, Correspondence, Chief CWS.

to determine the distance the bursting shell fragments would be thrown, so that serious injuries could be avoided.[57] The CWS wanted to ensure that the first use of chemical agents on a riotous mob would be effective yet not provoke hostile reaction in the press.

News stories of the calling out of CWS troops and the intention of using tear gas munitions, including the bombs to be dropped from airplanes, appeared in newspapers across the country.[58] The *Baltimore Sun* reported that "preparations by the army General Staff provide for employment of several units of the Chemical Warfare Service with equipment for using tear producing gas. While officials refused to comment, it was learned that orders had been given Brigadier-General Fries, chief of the Chemical Warfare Service, to have detachments of his forces ready for service in West Virginia. Use of tear gases has been found highly effective in experiments recently held by the army and by the police departments in Philadelphia and New York."[59]

Despite the preparations made by Fries to ensure a successful operation, tear gas was not used against the miners. The arrival of so many federal troops had an immediate quieting effect, and no resistance was encountered as the miners surrendered their weapons and peace was restored. On September 7, most of the forces were withdrawn, including the CWS detachment. R. F. Maddux, the senior CWS officer assigned to West Virginia, reported that "the mere presence of gas had a very good effect, and it is believed that it would have been the one weapon to have settled this disturbance without causing an unlimited amount of casualities on both sides."[60] Some of the tear gas was used by the CWS detachment for a demonstration to the officers from Camp Dix, New Jersey, and Maddux reported that the hand grenade and 25-pound aviation bomb proved to be highly successful in this trial.[61] After examining the reports of this operation, Fries prepared a detailed pamphlet, *Provisional Instructions for the Control of*

[57]Memorandum, C. W. Mason to Chief, Chemical Warfare Service, September 6, 1921; and S. P. Johnson, "Activities of the Mechanical Division with Regard to the Mingo Affair," August 30, 1921, ibid.

[58]The stories puzzled many CWS officers who were not yet aware of the change in policy of the War Department. The story in the Chicago papers was noted by the local chemical officer in a letter, L. M. McBride to Chief, Chemical Warfare Service, September 3, 1921, ibid. DeLanoy wrote to Fries on September 2, "Note by this morning's paper however that the General intends to drop gas bombs from aeroplanes" (DeLanoy to Fries, September 2, 1921, ibid.). See *New York Times* (September 2, 1921).

[59]*Baltimore Sun* (September 3, 1921).

[60]R. F. Maddux to Chief, Chemical Warfare Service, September 17, 1921, Correspondence, Chief CWS.

[61]Charles W. Walton to Chief of the Chemical Warfare Service, September 10, 1921, and R. F. Maddux to H. R. Lebkicher, September 30, 1921, ibid.

Mobs by Chemical Warfare, which he hoped would assist the CWS in carrying out similar operations in the future.[62]

Despite Fries's plans for the future, the War Department's prohibition of the use of tear gas on civilians was reinstated soon thereafter, and the opportunity for CWS troops to demonstrate their new weapon in a riot situation was prevented. This time the secretary of war reacted to the United States agreement to a prohibition of all chemical warfare at the January 8, 1922, session of the Conference on the Limitation of Armament, held in Washington. According to the terms of this agreement, "the use in war of asphyxiating, poisonous or other gases and all analogous liquids, materials or devices" was prohibited.[63] On January 14, 1922, the War Department issued the following order to Fries: "It has been decided that, pending final action by the Conference on the Limitation of Armament as to the use in war of non-toxic and other gases, no tear gas grenades or gas bombs of any sort shall be distributed by the War Department, either to states or corps areas, for the purpose of possible use in cases of civil disorder."[64] Although the prohibition was signed by the major world powers on February 6, France ultimately failed to ratify the treaty because of its submarine provisions, and consequently it never became binding. Nevertheless, the War Department correctly interpreted public opinion at this time to be in support of the prohibition of all chemical warfare, and the prohibition of tear gas munitions remained in effect. Six months later, Pershing accepted the view promoted by the CWS that the intent of the agreement allowed the use of nontoxic gases for internal disorders.[65] During the summer of 1922, tear gas demonstrations were given by the CWS at a number of National Guard camps, and, as a result, requests for such munitions increased.[66] On July 21, 1922, all corps areas were given a temporary authorization by the War Department to use tear gas for civil disturbances in connection with the railroad strikes. On August 14, 1922,

[62]U.S. Army, Chemical Warfare Service, "Provisional Instructions for the Control of Mobs by Chemical Warfare," November 21, 1921; rev. August 1, 1922. Technical Library, Edgewood Arsenal.

[63]U.S. Department of State, *Conference on the Limitation of Armament* (Washington, D.C., 1922), p. 738.

[64]Telegram, Adjutant General, for the Secretary of War, to Chief, Chemical Warfare Service, January 14, 1922, Correspondence, Chief CWS.

[65]General Pershing was described as being in favor of distributing CWS tear gas munitions in case they were needed, regardless of the prohibition of their use in civil disorders (C. W. Exton to Chief, Chemical Warfare Service, July 11, 1922). At this time, two assistant chiefs also recommended that tear gas grenades be issued in case they were needed for civil disorders (memorandum, William Lassiter to Chief of Staff, July 13, 1922; and memorandum, W. D. Conner to Chief of Staff, July 10, 1922, ibid.).

[66]Amos A. Fries to Adjutant General of the Army, October 5, 1922, ibid.

the use of tear gas was authorized for the Panama Canal Zone, Hawaii, and the Philippine Islands.[67]

Finally, after repeated requests, the CWS was authorized on February 12, 1923, to sell tear gas grenades to National Guard units, but only for use in training forces in riot control.[68] However, for their operations, the National Guard often purchased needed munitions from private manufacturers, and as early as 1921, tear gas grenades were available from this source.

Tear gas was first used on civilians by police forces and not troops of the CWS or the National Guard. While the War Department's ban prohibited both the use of tear gas by federal forces and the sale of tear gas munitions by the CWS, there was no prohibition on their use by police forces. However, as long as the sole source of tear gas grenades was Edgewood Arsenal, the War Department's ban effectively prevented the use of this new weapon by the police. This situation changed in the summer of 1921, when DeLanoy formed his new business, Chemical Protection. It was through private firms that tear gas became part of the arsenals of nearly every city police department in the United States. By the end of 1923, over 600 cities had been equipped with tear gas, and several reports of its use had already appeared.[69] The loss of exclusive use of this weapon was the result of active support given private suppliers of tear gas munitions by the CWS.

CWS Aid to Private Suppliers

In order to encourage the adoption of tear gas munitions by the nation's police forces, the Chemical Warfare Service aided in the establishment of firms for their manufacture. The CWS could not sell military tear gas grenades to police forces, since these weapons could not be classed as surplus property. However, a precedent had been set during the war for the donation and selling of small quantities of chemical agents to individuals for research purposes. This procedure was continued by the CWS after the war in order to interest chemical industries in production of substances which would be essential for carrying out chemical warfare in the event of another war. The CWS was aware that importance of maintaining a strong chemical industry

[67]Memorandum, "CWS Functions," Chief of Chemical Warfare Service to Chief of Staff, March 28, 1927, p. 5, Policy File, Edgewood Arsenal Historical Office.

[68]Telegram, Adjutant General, for the Secretary of War, to Chief, Chemical Warfare Service, February 12, 1923, Correspondence, Chief CWS.

[69]*New York Times* (September 17, 1923). Such reports appeared in the *New York Times* of the use of tear gas in Jackson, Kentucky (December 16, 1921), in Jackson, Michigan (June 15, 1922), in Lincoln, Nebraska (August 5, 1922), and in Ionia, Michigan (August 30, 1922).

during peacetime had been one of the great lessons of World War I.

Most of the firms which entered the tear gas business from 1920 to 1930 were organized by former officers of the CWS, men who were familiar with the use of chemicals in war and who recognized the ready market for tear gas equipment at a time when major strikes created a fear of mob violence in America. The first of these men was Stephen J. DeLanoy. The assistance given by the CWS to DeLanoy in providing the grenades for his demonstrations and training courses has been mentioned. In addition, following these demonstrations, the CWS received requests for tear gas grenades from banks and police forces and referred them to DeLanoy's company and to other tear gas suppliers as they were formed.[70]

DeLanoy worked with the DuPont Company in the design and manufacture of a special lead-lined, celluloid grenade body which could be filled with a solution of chloroacetophenone in organic solvents. Soon after the completing of the training course, an appropriation of $2,500 to purchase tear gas equipment was made by the city council of Philadelphia, and DeLanoy received his first order.[71] At this time, the CWS had the only large supply of chloroacetophenone, produced during the last months of the war by the small-scale plant at American University, and they anticipated an unlimited supply once the factory under construction at Edgewood Arsenal, the only one in the country, was completed. The CWS therefore felt no need to be frugal with its supply, and as long as the quantities were small enough to constitute samples for "research purposes" the CWS could sell or give away chloroacetophenone according to the policy established by the War Department. The records of the CWS indicate that a considerable amount of chloroacetophenone was given to DeLanoy when he visited Edgewood Arsenal in November 1921 just prior to the start of his course of instruction in Philadelphia.[72] In this course, DeLanoy taught 102 officers from the Philadelphia police force, as well as representatives from other cities who were later to serve as instructors for their own forces. In August 1922, DeLanoy visited Edgewood Arsenal to inspect the new chloroacetophenone factory, because he planned at that time to set up a small plant of his own.[73] However, DeLanoy did not manufacture

[70]E.g., see Amos A. Fries to American Guaranty Co., September 26, 1921, Correspondence, Chief CWS.

[71]*New York Times* (October 27, 1921).

[72]The records conflict as to whether 2 or 48 gallons of chloroacetophenone solution were involved (memorandum, W. C. Baker to General Fries, February 27, 1922, Correspondence, Chief CWS; and memorandum, Commanding Officer, Edgewood Arsenal to Chief, Chemical Warfare Service, November 15, 1921, ibid.).

[73]S. J. Delanoy to Amos A. Fries, August 18, 1922, ibid.

his own chloroacetophenone, but during the next few years he was able to purchase sufficient amounts from the Eastman Kodak Company to fill his orders.[74]

In 1922 Ruben B. Lawrence, formerly a captain in the CWS, founded the Lawrence Company, Pittsburgh, Pennsylvania, a manufacturer of tear gas devices. To assist Lawrence in establishing his firm, in March the CWS gave him a quart of chloroacetophenone solution and two months later sold him 25 pounds of chloroacetophenone and twelve tear gas grenades.[75] In explaining the policy of the CWS, it was stated that "the Chief of the Chemical Warfare Service desires to be of as great assistance as possible to Mr. Lawrence in undertaking this manufacturing venture."[76] Lawrence subsequently visited Edgewood Arsenal to learn the operation of the chloroacetophenone plant and was provided with complete technical information and blueprints of the plant.[77] Subsequently, the CWS decided that large amounts of chloroacetophenone could not be sold for "research purposes" and refused Lawrence's request for 200 pounds to enable him to fill immediate orders until his own plant was in operation.[78] In 1923, the Lawrence Company became Federal Laboratories, Incorporated, and, upon acquisition of the rights to the patents for slow-burning tear gas grenades that had been issued to the researchers of the CWS, Federal Laboratories grew to become one of the largest suppliers of tear gas equipment in the world.[79]

The other prominent tear gas supplier that began operation at this time was the Lake Erie Chemical Company of Cleveland, Ohio. Byron C. Goss, formerly a lieutenant colonel in the Gas Service, AEF, founded the company in 1925 and served as its president for over twenty years. To assist him in his initial research and development, the CWS sent Goss 5 pounds of chloroacetophenone in 1926.[80] Goss soon developed a complete line of tear gas grenades filled with a

[74]The Eastman Kodak Company made this compound in very small batches in its laboratories (George A. Mackay to Chief, Chemical Warfare Service, November 22, 1926, ibid.).

[75]Memorandum, W. C. Baker to Commanding Officer, Edgewood Arsenal, March 23, 1922; memorandum, W. C. Baker to Chief, Chemical Warfare Service, May 12, 1922; and memorandum, A. Gibson to Commanding Officer, Edgewood Arsenal, May 12, 1922, ibid.

[76]Memorandum, A. Gibson to Commanding Officer, Edgewood Arsenal, June 19, 1922, ibid.

[77]R. B. Lawrence to A. Gibson, July 3, 1922, ibid.

[78]C. E. Brigham to R. B. Lawrence, August 7, 1922, ibid.

[79]U.S. patents: 1,659,158 issued to Nicholas E. Oglesby and Day E. Ehrenfeld, February 14, 1928; 1,565,899 issued to Donald B. Bradner, December 15, 1925. Oglesby was chief of the munitions department of the CWS from 1920 to 1924 and served as the assistant chief of the CWS from 1924 to 1929.

[80]F. R. Garcin to B. C. Goss, March 24, 1926, Correspondence, Chief CWS.

solution of chloroacetophenone which was vaporized by a bursting charge.[81] The Lake Erie Chemical Company and Federal Laboratories dominated the field of tear gas munitions throughout the next decades, and the CWS continued to be of assistance to these and other smaller firms by providing technical assistance, tests of their products, and referrals to police departments of current lists of suppliers.

Conclusion

Tear gas, a wartime discovery of the Chemical Warfare Service, ultimately found greater application in peacetime as a powerful police weapon. Police forces equipped with tear gas munitions did not often need the assistance of federal troops to handle domestic disorders. The availability of tear gas is coincident with an abrupt drop in requests by local authorities for federal troops or National Guard forces in such situations.[82] This increase in the power of police represents the most significant impact of tear gas research conducted during the war.

The reasons for tear gas becoming a munition in the hands of police rather than being restricted to use by CWS troops during periods of martial law were the opposition of the War Department to any expansion of the CWS from 1919 to 1921 and the stance taken by the United States at the Washington Arms Conference in January 1922 in favor of the prohibition of all chemical warfare agents. The effots of leaders of the CWS, especially Fries, in assisting firms to supply tear gas munitions to police forces were prompted chiefly by their narrow interest in the maintenance and growth of the CWS within the Army and also by a belief that tear gas was a much more humane weapon than firearms.

From a humanitarian viewpoint, the introduction of tear gas for civil riot control could be judged as beneficial in the sense that fewer deaths and injuries resulted from tear gas than from use of conventional weapons. Yet the dramatic increase in the power of police forces in handling mass disturbances certainly meant a loss of power to any group opposing established order. A few police armed with this weapon could disperse a mob easily and destroy the impact of a mass demonstration.

[81]Lake Erie Chemical Company developed this type because the patent rights to the slow-burning grenades were held by Federal Laboratories. The munitions developed by both firms are described in detail in Thomas F. Swearengen, *Tear Gas Munitions* (Springfield, Ill., 1966).

[82]The abrupt decline is noted in Marlin S. Reichley, pp. 169–70.