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U. S. ARMY CHEMICAL CORPS HISTORICAL STUDIES

GAS WARFARE IN WORLD WAR I

THE USE OF GAS AT SAINT MIHIEL
(90th Division in September 1918)

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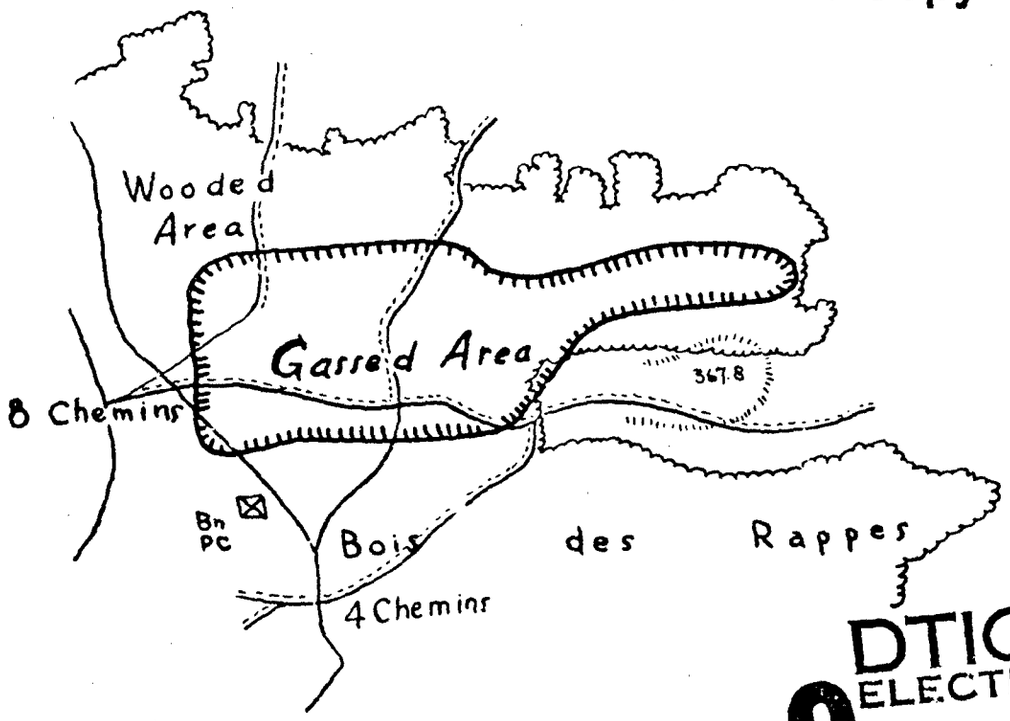

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Study No. 5

December 19

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The Use of Gas at St. Mihiel
The 90th Division, September 1918

by

Rexmond C. Cochrane

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HISTORICAL STUDIES

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Office of the Chief Chemical Officer
Army Chemical Center, Maryland

1957

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The Use of Gas at St. Mihiel
The 90th Division, September 1918

Prepared by

Rexmond C. Cochrane, Ph.D.

Under contract DA-18-108-CML-6214

with

U.S. Army Chemical Corps

This is an accepted draft study on gas warfare in World War I

W. R. CURRIE
Brigadier General, USA
Asst CCmlO for Planning & Doctrine

Foreword

This is a tentative study of the gas experience of the 90th Division at St. Mihiel during World War I. This study is not presented as a definitive and official history, but is reproduced for current reference use within the Military Establishment pending the publication of an approved history.

The author was assisted in his research by Mr. Walter O. Moeller and Mrs. Charlotte Bolin.

Note to Readers: Comments and suggestions relative to accuracy and adequacy of treatment are invited, and may be transmitted to the Chief, U.S. Army Chemical Corps Historical Office, Army Chemical Center, Maryland.

THE USE OF GAS AT ST. MIHIEL
THE 90TH DIVISION, SEPTEMBER 1918

by Rexmond C. Cochrane

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THE USE OF GAS AT ST. MIHIEL
The 90th Division, September 1918

The St. Mihiel operation is generally considered to have been a brief campaign in which little or no gas was used by the enemy. This was so for all the divisions in the attack with the exception of the 90th Division. In the operation between 12 - 17 September, it took over 500 gas casualties, and in the weeks of stabilization that followed almost another thousand casualties as a result of daily gas fire. Its gas casualties for the period were almost one-third of its total battle casualties.

The campaign was the first large-scale operation carried out by the AEF and the first undertaken by the newly formed First American Army. In the earlier divisional operations at Cantigny, Chateau Thierry, Soissons, and the Aisne Valley, the American command had witnessed the effectiveness of gas warfare. At St. Mihiel the command was to take the first steps towards acceptance and use of the gas weapon.

The Salient

The weakest link in the iron chain drawn by the German Armies across France and Belgium in 1914 was the St. Mihiel salient. Yet the position had been held fast for four years by the enemy against repeated assaults of the French, who were said to have lost over 100,000 men alone in the Bois le Pretre, and with each year the German trench system and wire entanglements there became more elaborate and the enemy dugouts and living quarters more commodious and luxurious.

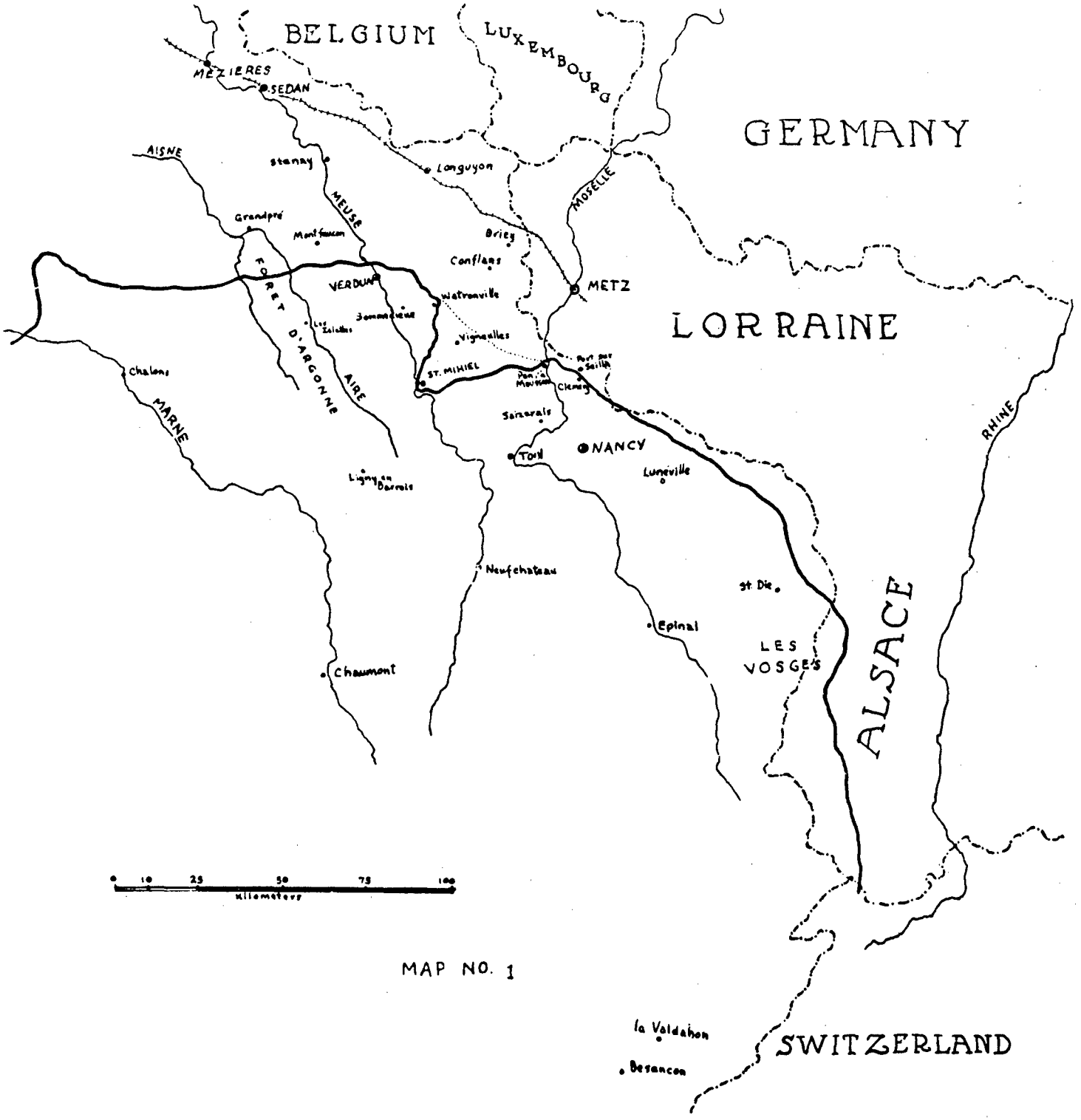
The Germans held the salient, 16 miles deep, as protection for the city-fortress of Metz, the Briey coal mines, and the Metz-Sedan lateral railway to Flanders. The French fought for the salient because it hampered their rail communications between Paris and Lorraine, and threatened the rear of the fortresses of Nancy and Verdun (Map No. 1).

Following the last of the German spring offensives of 1918, the assault of 15 July across the Marne, the Allies had returned to the offensive by striking at the flanks of the dangerously extended German Armies between the Aisne and Marne, thereby precipitating their slow withdrawal back to the Aisne. On 24 July, while the Aisne-Marne operation was still in progress, Foch called Pétain, Haig, and Pershing together to present his plans for the remainder of 1918. Petain was to continue the reduction of the Marne salient. Haig was to resume the offensive before Amiens and then at Arras. The task of reducing the St. Mihiel salient was assigned to Pershing, but no date was set.[1]

On 31 July, Pershing set up First Army headquarters at La Ferte and preparations for the St. Mihiel operation began at once. On 6 August, the Aisne-Marne campaign ended and a week later First Army headquarters opened at Neufchateau (on 30 August, Ligny en Barrois), in the St. Mihiel area, and the concentration of troops began. Originally intended by Pershing as a major attack towards Metz and Conflans, at the end of August the objectives of the St. Mihiel operation were reduced at French direction

---

1 Brig Gen Fox Conner, Reduction of the St. Mihiel Salient, n.d. (1st A Box 74, 50.1); lecture, Col L. H. Watkins, GS, Plans of St. Mihiel Opn, 18 Dec (1st A Box 74, 58).


BELGIUM
LUXEMBOURG
GERMANY
LORRAINE
ALSACE
SWITZERLAND
MEZIERES
SEDAN
AISNE
Stenay
MEUSE
Longuyon
MOSELLE
Grandpré
Montfaucon
Briey
Conflans
METZ
VERDUN
FORET D'ARGONNE
Watronville
Les Islettes
Jonnelieu
Vigneulles
Chalons
MARNE
AIRE
ST. MIHIEL
Pont à Mousson
Pont sur Seille
Clemecy
Sainvrais
TOUL
NANCY
Lunéville
RHINE
Ligny en Barrois
Neufchateau
St. Die
Epinal
LES VOSGES
Chaumont
10 25 50 75 100
Kilometers
la Valdahon
Besancon

MAP NO. 1

by six to eight miles, in order to mount the Meuse-Argonne offensive, towards Mezières, as soon after closing the salient as possible.

On 30 August, Pershing's First Army, functioning under headquarters of the French Armies of the East and Northeast and comprising I, IV, V American and II French Colonial Corps, moved into the line between the Second and Eighth French Armies, on the front from Watronville east to Port sur Seille.[2]

A week later, Army Field Order 9 presented the plan of attack to force enemy evacuation of the salient. In an operation expected to take two to three days, V Corps from the west and IV Corps from the south were to advance on Hattonville-Vigneulles in a pincers movement to cut off the enemy forces in the salient. I Corps, hinged on the Moselle, was to attack towards Thiaucourt, on the Army Objective, while II Colonial Corps, starting an hour after the corps on either side, was to advance up the axis line St. Mihiel-Hattonville, mopping up the enemy forces caught in the salient (Map No. 2).[3]

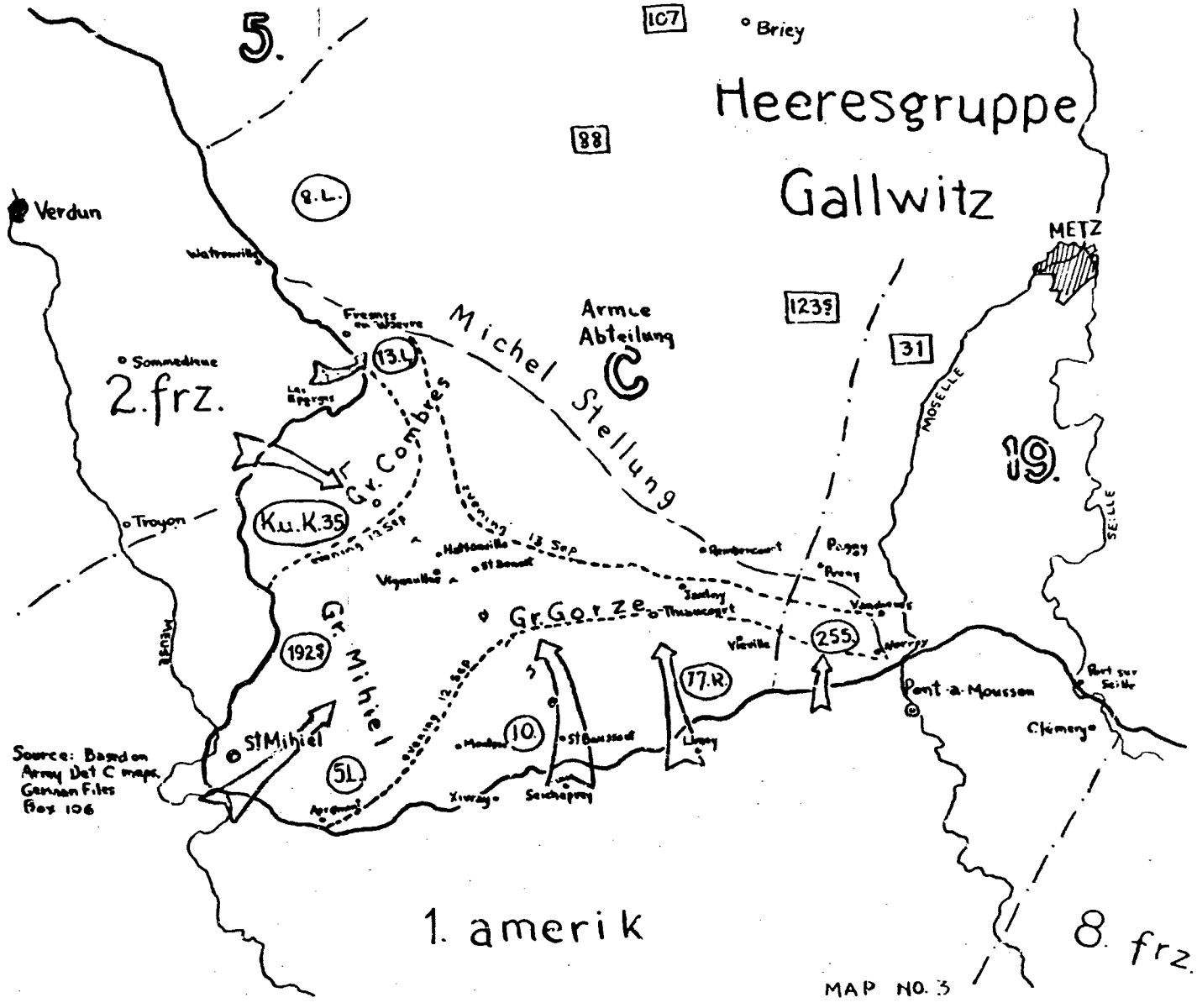
Seven German divisions, organized in three groups under special Army Unit C and commanded by Lieutenant General Fuchs, held the St. Mihiel salient (Map No. 3). Under the code name "Loki," plans for an organized withdrawal from the sector had long been ready. These plans allowed eight days

---

2 FO 8, 1st A, 12 p.m., 29 Aug (1st A Box 33).

3 FO 9, 1st A, 7 Sep; FO 49, 1st C, 9 Sep. Note: The letter divisions on Map No. 2 represented operational sectors established prior to assignment of the actual numbered divisions.

COMMERCE
Army
Reserve


5.
107
Briey
Heeresgruppe
Gallwitz
88
8.L.
Verdun
METZ
Watronville
Fresnes en Woevre
Armee
Abteilung
C
123?
31
Michel Stellung
13.L.
Sommedieue
2.frz.
Les Eparges
Gr. Combres
MOSELLE
19.
Ku.K.35
Troyon
Hattonville
13 Sep
St Benoit
Vigneulles
Gr. Gorze
Thiaucourt
Vandeleuvre
255.
192?
Gr. Mihiel
77.R.
Pont-a-Mousson
Clémery
St Mihiel
10.
St Baussant
Liny
51.L.
Xivry
Souchapey
Source: Based on
Army Det C maps.
German Files
Box 106
1. amerik
8. frz.
MAP NO. 3

for the removal of war materiel and destruction of defensive works and fo days to move the holding troops back to the main fortified position in th Hindenburg Line, designated here as the Michel Stellung. In the event of a surprise attack, the retreat was to be made in two nights, with removal of materiel curtailed.[4]

Despite the efforts of First Army to prepare its attack in secret, on 1 September Army Unit C received a warning message from the Supreme Command that "Reports to the effect that the Americans intend to advance alon both banks of the Moselle toward Metz become more numerous." The next day removal of war materiel from the salient began, only to be delayed by Army Group Gallwitz's refusal to put Loki into full effect.[5] Daily, the enemy became more certain that an attack was to be made on the salient. Nevertheless, when it came it was a complete tactical surprise.

The 90th Division in the Saizerais Sector

The 90th Division, its troops largely from Texas and Oklahoma, was formed at Camp Travis, Texas, on 25 August 1917 and after long service

---

4 See German plan of evacuation of the salient, June 1917, in 90th Div Box 5, 22.

5 Maj Gen Baron Otto von Ledebur, CofS, Army Unit C, "Rushing the St. Mihiel Salient," in As They Saw Us, pp. 180 - 194.

as a replacement training unit,[6] became the twenty-second American division to land in France, arriving at its training area north of Dijon, in the Coté d'Or, in July 1918. A month later, it was at the St. Mihiel salient, where it relieved the 1st Division, then resting in the Saizerais sector, north of Toul, after the Soissons operation.[7]

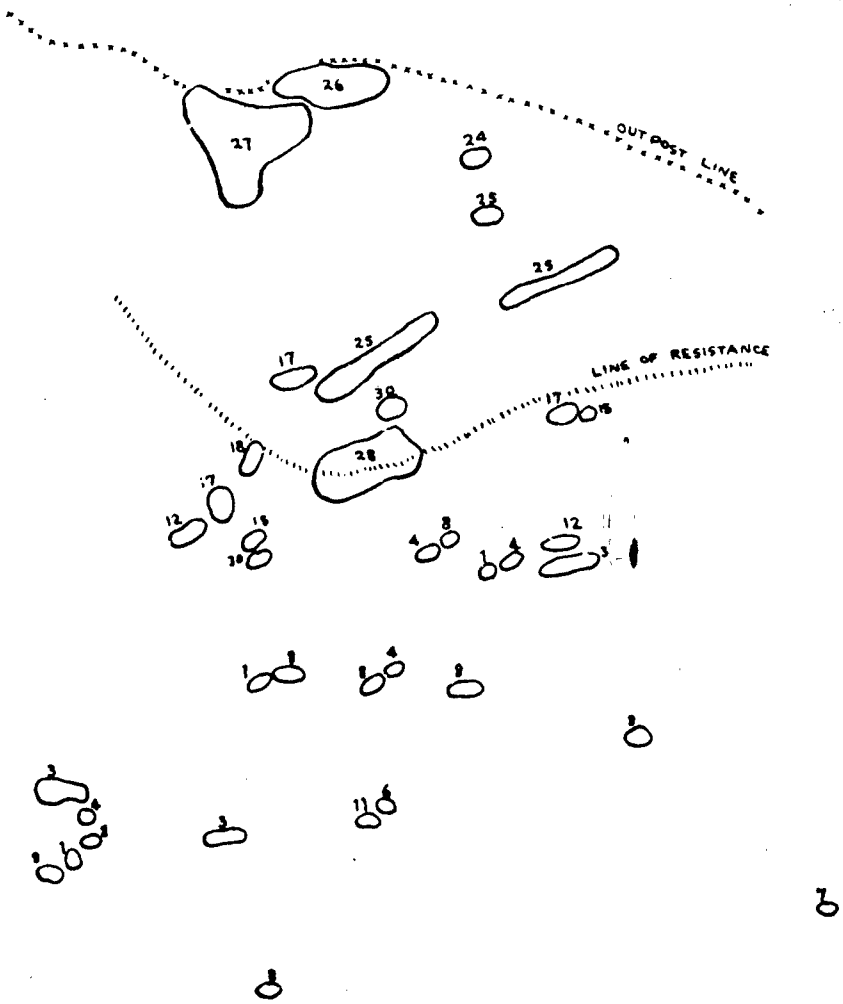
On 22 August, the 90th Division, commanded by Maj. Gen. Henry T. Allen, came into the line between Remenauville and the Bois le Prêtre, a front of nine kilometers (Map No. 4). Moving into the left sector was the 179th Oklahoma Brigade composed of the 357th and 358th Infantry, under Brig. Gen. Joseph P. O'Neil. On the right was the 180th Texas Brigade composed of the 359th and 360 Regiments, under Brig. Gen. William H. Johnston (after 27 August, Brig. Gen. Ulysses G. McAlexander). At divisional headquarters at Villers en Haye was the 1st Division field artillery, relieved on August 28 by Brig. Gen. Clint C. Hearn's 153rd FA Brigade (78th Division), which was to support the 90th Division throughout the operation.[8]

---

6 Unlike many earlier units rushed to France, the 90th trained in trench warfare in the States for about a year and sent large numbers of its personnel to divisional schools set up for training in gas defense, signals, the French language, hygiene and sanitation, training of stable sergeants, saddlers and cobblers, horseshoers, teamsters, bandsmen and buglers, mess sergeants, cooks, bakers, and clerks. For almost complete courses of study in the division's School of the Army, see 90th Div Box 13. For the gas training of the division in France, see ltr 29, Jan 1919 in 90th Div Box 87.

7 FO 2, 90th Div, 19 Aug (90th Div Box 6, 32.1).

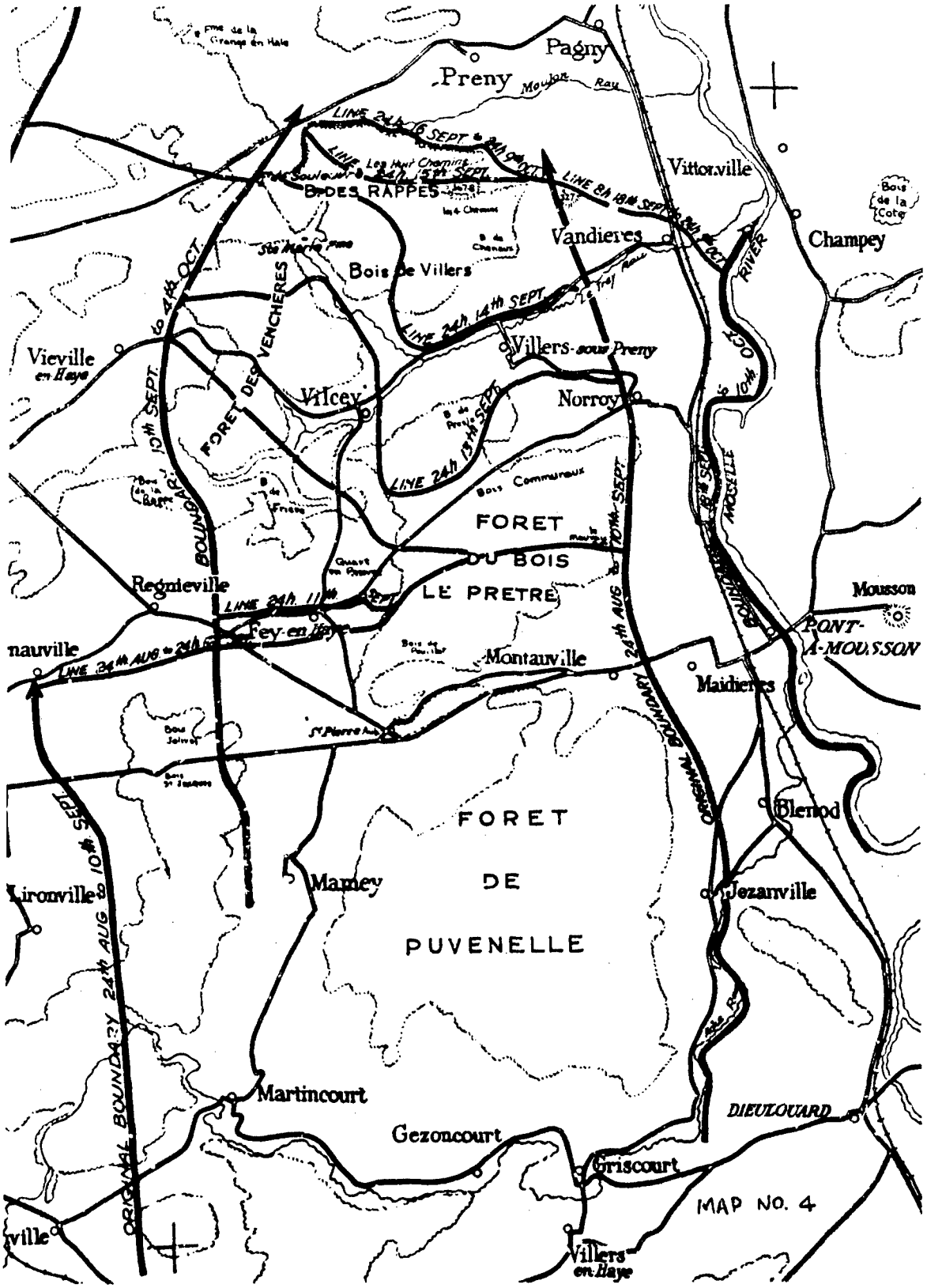
8 The organic arty of the 90th, the 165th FA Brig, did not join the division until after the Armistice.



Source: Overlay of "portion of areas gassed by the enemy... month of September," atchd to ltr DGO to C CWS, 7 Oct (90th Div Box 87 - DGO)

Note: Numbers represent dates in Sept.

OVERLAY FOR MAP No. 4


Pagny
Preny
Vittorville
Champey
Vandieres
Bois de Villers
Villers-sous-Preny
Vieville en Haye
Vilcey
Norroy
FORET DES VENCHERES
FORET DU BOIS LE PRETRE
Regnieville
Fey-en-Haye
Montauville
Mousson
PONT-A-MOUSSON
Maidieres
Blenod
FORET DE PUVENELLE
Mamey
Jezainville
Lironville
Martincourt
Gezoncourt
Griscourt
DIEULOUARD
Villers en Haye
ORIGINAL BOUNDARY 24th AUG to 10th SEPT
BOUNDARY 24th AUG to 10th SEPT
BOUNDARY 10th SEPT to 4th OCT
MOSELLE RIVER
MAP NO. 4

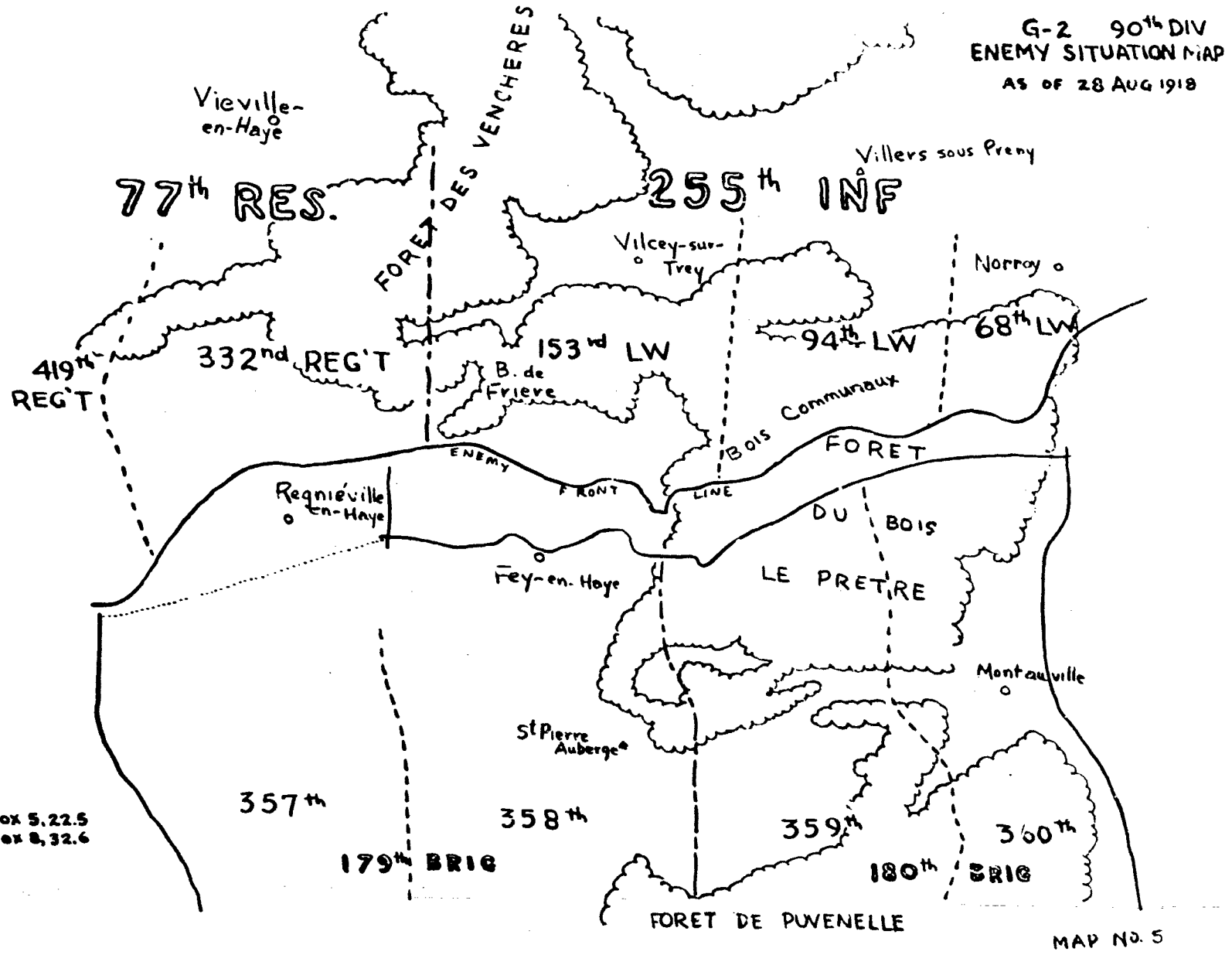
Facing the 90th Division from the left of the sector to the Bois de Fr[illegible]re was a regiment of the 77th Reserve Division, a battle division reported below average, and from the Bois de F[illegible]re to the Moselle was the 255th Division, a landwehr unit that like the 90th had "never engaged in real combat" (Map No. 5).[9]

The terrain in the salient was rolling country with open hilltops and wooded ravines, its outstanding feature a continuous and complete trench system of deep revetted trenches and concrete dugouts that had been under construction for four years and extended approximately seven kilometers in depth on the 90th Division front, back to the Michel Stellung, running westward from the vicinity of Pagny. The 90th Division occupied an abandoned series of first line trenches that had been wired and filled with wire upon abandonment, from west of Quart en Reserve through Faye en Haye and the heavily wooded Bois le Pretre. In front of the division were five front line trenches and communicating trenches of the enemy first position, extending one to two kilometers in depth, all heavily wired, with a great number of the communicating trenches filled with loose wire and accordian wire as the enemy reduced his front line forces.[10]

---

9 1st Div Plan of Defense of Saizerais Sector, 9 Aug (90th Div Box 3, 20.1); 90th Div G - 2 Sum of Info, 11 Sep (Box 5, 20.8).

10 Rpt of St. Mihiel Opn, 12 - 15 Sep (90th Div Box 5, 22.2); ltr, CG 180th Brig to CG 90th Div, 18 Sep, subs Rpt (Box 19, 33.6). See also 16-page Study of the St. Mihiel Salient, including history of German divisions there (Box 8, 32.4). For a sketch of the trench and wire system in and around Faye en Haye, see 90th Div Box 23, 33.1.


G-2 90th DIV
ENEMY SITUATION MAP
AS OF 28 AUG 1918
Vieville-en-Haye
77th RES.
FORET DES VENCHERES
255th INF
Villers sous Preny
Vilcey-sur-Trey
Norroy
419th REG'T
332nd REG'T
153rd LW
B. de Frieve
94th LW
68th LW
Bois Communaux
FORET
ENEMY FRONT LINE
Regnieville en-Haye
DU BOIS
Fey-en-Haye
LE PRETRE
Montauville
St Pierre Aubergé
357th
358th
359th
360th
179th BRIG
180th BRIG
FORET DE PUVENELLE
Source
90th Div Box 5.22.5
90th Div Box 8.32.6

MAP No. 5

While the front lines were being organized for the assault, intensive training of the 90th Division was resumed on 26 August as one by one the battalions went to the Griscourt area to hold gas, close order, and bayonet drill and conduct maneuvers in offensive open warfare.[11] The degree of quiet maintained in the trenches along the Saizerais front from 22 August to 12 September, in order to mask preparations for the attack, may be gauged from the fact that total battle casualties reported by the 90th Division up to zero hour were 10 men killed and 39 wounded.[12] This, despite the fact that on at least one occasion (at 2:15 a.m. on 26 August), gas sentinels in the 359th Infantry sector picked up a gas alarm from an adjoining sector and gave the alarm by ringing bells and sending up green rockets and then called for a barrage with a red rocket.[13]

The divisional Summaries of Intelligence for the three weeks prior to 12 September record the number of enemy shells falling in the sector on but 14 of those 21 days. Gas shells as well as HE fell on 11 of the 14 days, for a cumulative total of 5,639 rounds, including approximately 700 gas rounds, almost all blue and green cross shell. As certainty of

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11 Memo, G - 3, 26 Aug, sub: Training (Box 12, 50.4).

12 Maj George Wythe, Asst G - 3, A History of the 90th Division, p. 18. This is a 155-page MS history in 90th Div Box 1, 11.4, published almost intact in 1920 by the 90th Div Assn, De Vinne Press, Texas. Citations will be to the MS history, hereafter referred to as Wythe.

Daily Opns Rpts (90th Div Box 9, 33.1) for the period show only 3 wounded and 12 gassed, altho later medical and gas records (see Analysis) show a minimum of 72 wounded and 46 gassed during that period.

13 RGO Rpt in 90th Div Box 87 (DGO file).

the attack grew, enemy harassing fire increased gradually over the three-week period, from as few as 60 rounds on 24 August to as many as 1,000 rounds on 9 September. The greatest number of gas shells reported on any one day was 200, on 4 September, resulting in 14 gas casualties.[14] Of the gassing Maj. George A. Hunt, the Division Gas Officer, said in his report for the week of 7 September:

> Comparatively few shells have been sent over [since coming into the sector], mostly Blue Cross. One night 20 mustard shells came over but the holes were treated at daylight and no casualties. The real gas shells coming over are appreciated as they afford good training. Our principal difficulty has been in curbing false alarms. False alarms have in the past spread for 7 kilometers, clear across our front, but [are] now localized sharply.[15]

With the completion of Army's organization of the Watronville-Clemery sector and its order on 7 September for the attack, I Corps issued plans for the defense of its front and for the coming offensive. Annex 3 of the corps order warned that "Information obtained from prisoners points to the fact that the enemy is accumulating Yellow Cross (Mustard Gas) shells opposite our sector," and the construction of gas-proof dugouts was therefore ordered with utmost speed, so the men might "rest in safety without discomfort and fatigue from wearing the respirator."[16] There was no

---

14 SOI Nos. 1 - 20, 23 Aug - 12 Sep (90th Div Box 3, 20.1). In most instances gas shells are reported as a percentage of the daily total of enemy shells fired, ranging between 20 and 40 percent. The most frequent targets were the Bois de Puvenelle, Bois Jolival, and Auberge de St. Pierre.

15 Ltr to C CWS, 8 Sep (90th Div Box 87).

16 FO 46, 1st C, 8:00 a.m., 8 Sep and Annex 3, Plan of Gas Defense (1st C Box 15).

haste to carry out the order in the 90th Division sector: "The policy has been adopted to proceed very slowly in gas proofing dugouts. There are few dugouts in the sector that are so constructed that they can be made gas dugouts. All curtains, etc. which might give false sense of security are being removed....The present policy is to evacuate [to alternate positions] rather than seek refuge in dugouts."[17] As reports of inspection through 9 September indicate, the policy was maintained and "only a certain few dugouts in each strong point" were gas-proofed. Chloride of lime seems to have been in short supply, but otherwise troops were provided with quantities of "soap suds for mustard gas" and instructed to use them on their eyes, nose, and throat in the event of contamination.[18]

The 90th Division continued preparations across its wide front until the night before the attack, when the 5th Division moved into the left subsector around Regnieville, previously occupied by the 357th Infantry of the 90th Division, and the 2nd Division, extending the corps front, took over the right subsector of the 89th Division (IV Corps). The 82nd Division, astride the Moselle to the right of the 90th, remained

---

17 Ltr, DGO to C CWS, 26 Aug, sub: Rpt for week ending 26 Aug. Ltr, AC of Def Div CWS to DGO, 3 Sep, said his dugout policy was "in exact accord with that adopted by this service."

The 90th Div arty comdr had asked for protective suits; the same letter said they were not CWS issue and there was doubt of their value since they caused excessive perspiration and therefore increased the severity of mustard gas burns.

18 Rpts of Insp, 25 Aug - 9 Sep (90th Div Box 10, 37.9).

in place. In reserve behind these four divisions was the 78th Division.[19] In all, there were 216,000 Americans and 48,000 French around the perimeter of the St. Mihiel salient and almost 190,000 Americans in reserve. Opposite them were at most 75,000 German troops.

The Artillery Preparation

Until the day before the attack the Army order for the assault on the salient contemplated no artillery preparation, the troops to advance under a massive barrage. The corps order stated that the artillery action would start on D Day at H Hour, with

> All Stokes Mortar units [of Companies C and E of the 1st Gas Regiment]...provided with phosphorus bombs...for smoke screens as desired, and with thermite...for use against machine-gun nests or other enemy units within their range. Projector units will install projectors for throwing H.E....After the above operations...the Stokes Mortars will be attached to the Divisions and will be available, at any time, to assist in the attack with gas, smoke or thermite.[20]

The 90th Division order said the 179th Brigade would attack without artillery preparation due north along the line Fey en Haye-Foret des Vencheres, accompanied by a rolling barrage and raking fire throughout the zone of attack. The special mission of the 180th Brigade was to protect the right flank of the division, the 359th Infantry attacking in the direction of the Bois de Villers while the 360th, swinging with the attack, held its anchor position of the right.[21] The 82nd Division alongside would remain in place.

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19 FOs 47, 48, 1st C, 9 hr, 8 Sep.

20 Annex 10, FO 49, 1st C, 16 hr, 9 Sep.

21 FO 4, 360th Inf, 16 hr, 11 Sep (90th Div Box 25, 33.6).

A thousand S-1 smoke candles were to be used on the 360th Infantry front in the attack and 200 on the 358th Infantry front, if the wind was favorable. KJ irritating gas grenades might be included in the smoke at the discretion of the Battalion Gas Officers.[22] The 359th and 360th Infantry were also to have 200 #27 WP hand and rifle grenades at the hour of attack for use against enemy machine gun emplacements and strong points, and all regiments would carry them for covering operations and reduction of machine gun nests.[23]

Two platoons of the 1st Gas Regiment were to fire smoke and thermite on the division front during the first half hour of the attack, in addition to projector shoots with HE, thermite, stench gas, and fake flashes. These latter operations would take place regardless of wind direction. "The Gas and Smoke used in all of above operations are non-poisonous and may be passed through without use of gas masks," the Gas Annex concluded.[24]

General Hearn was clearly disturbed by the absence of preparatory fire. In addition to his organic guns and mortars, he said in his initial operations order, the 90th Division would be reinforced by 9

---

22 That the candles were used, and 200 KJ grenades were thrown into the smoke on the 360th Inf front, is confirmed in Ltr, DGO to C CWS, 20 Sep, sub: Smoke Screens vs M.G. Nests (90th Div Box 87).

23 See below, Analysis.

24 FO 3, 90th Div, 17 hr, 9 Sep, and Annex to par 3(h): Plan for Smoke and Gas.

batteries of 75's (the 238th French FA), 2 batteries of 155's and 4 batteries of 220's (the 183rd and 282nd French FA), 2 batteries of 58-mm. trench artillery, 6 150-mm. guns, and 26 240-mm. guns (the 1st American and 10th French Trench Artillery). (There was to be a total of almost 3,000 guns on the St. Mihiel front, as well as 400 tanks and 1,480 airplanes.) The special mission of the artillery would be wire-cutting and destruction of machine gun nests. Of the principal obstacle on the right of the divisional front, General Hearn said: "It is believed that a few hours of artillery action on the Bois le Pretre will reduce that stronghold to a state affording an easy, although necessarily slow, advance."[25] But as yet there was no plan for such a preparation.

The story behind First Army's frequent change of plans concerning an artillery preparation with gas and HE for the St. Mihiel operation is still incomplete. The confusion was only partially summed up in the sentence: "The artillery preparation was at first to be 4½ hours, then 14 hours, then 22 hours, then no artillery preparation, and finally 4 hours."[26]

Plans for the artillery fire seem to have changed almost daily. On 22 August, General Drum, First Army Chief of Staff, acknowledging that "the greatest obstacle will be wire," said the preparation would

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25 153rd FA Opns O, 7 Sep, sub: Tentative Plan for Employment of Div Arty in Offensive (78th Div Box 24, 32.13).

26 Col L. H. Watkins, GS, lecture: Plan of St. Mihiel Opns, 18 Dec, p. 10 (1st A Box 74, 58).

begin at H minus 4½ hours. The next day the initial artillery plan, on which ammunition requirements were based, called for "a very violent bombardment for 4 hours and 45 minutes before H Hour....with 2011 guns." Two days later, General McGlachlin, Chief of Army Artillery, said that approximately 24 hours of fire would actually be required to destroy the two lines of enemy wire on the St. Mihiel front.[27]

No hours of preparation were specified on 1 September when the First Army Ordnance Officer wrote that a 5-day allowance of ammunition would be on hand for the attack, with 75-mm. ammo in the proportion of 65 percent HE, 15 percent shrapnel, and 20 percent gas and smoke; 155-mm. ammo in the proportion of 90 percent HE, 10 percent gas, the gas probably to be 50 percent each of #4 and #5 (cyanogen and phosgene).[28] It was on that same day, 1 September, says Liggett, that "a conference was held at Toul with General Pétain commanding the French Armies, and the matter of artillery preparation for the coming battle was thoroughly discussed. A long artillery preparation precludes any possibility of a surprise attack,

---

27

Ltr, Drum to CG 1st A, 22 Aug, sub: Proposed offensive against St. Mihiel Salient (GAF-1st A); Plan of Opns, Army Arty, 23 Aug; Memo for CS 1st A, 25 Aug, sub: Wire Cutting (1st A Box 102, 44.6 Ammo).

28

Memo, Worcester for CofArty, 1 Sep, ibid. Memo, Kilbreth CS for CofArty, 1 Sep, said between 3½ and 4 days' fire was already on hand.

On 28 Aug, Pershing asked Pétain to increase the gas shell allotted to First Army because of the special nature of the opn. On 6 Sep, Pétain replied that First Army now had 23 percent gas shell for the 75s and 12.4 percent gas shell for the 155s, "which is more than French armies would get." Nevertheless, he would add 30,000 rounds of heavy arty gas to raise the gas proportion to 19 percent. US Army in the World War 1917-1919, Vol. 8, St. Mihiel, pp. 199 - 200.

and surprise was an essential element in this operation. A long artillery preparation was, however, eventually decided upon."[29]

Before the 4-hour preparation was decided upon, Army issued a series of conflicting and confusing orders. Its Battle Instructions, issued on the 2nd, said the preparation would begin at H minus 22 hours.[30] On the 3rd, Pershing accepted the limitation in scope of the attack that had been urged by the French, but was still undecided about the length of preparation the assault would require. Army's order for the attack on 7 September said "The artillery fire (including preparation) will start at H Hour minus the time desired by corps commanders for beginning of the barrage fire....If gas is used..." it will cease four hours before the attack.[31]

Attempting to clarify this, the Chief of Staff said in a memorandum that same day: "There will be no preliminary artillery bombardment. The artillery fire will start at H Hour minus the time desired...for beginning of the barrage fire." However, "the army commander directs that plans be prepared for a preliminary bombardment of 14 hours...[so]

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29 Hunter Liggett, Commanding an American Army, p. 61.

30 In MS Hist of CWS, AEF, Vol. V, Appendix, p. 61 (SOS Box 249). The confusion is typified in the detailed gas plans of the IV Corps Gas Officer, who on 28 Aug prepared plans based on either a 22-hour or a 4-hour preparation, and on 2 Sep made plans for 4½-hour and 18-hour artillery preparations. See Memos, CGO for CG 4th C, 4th C Box 12, 32.11.

31 FO 9, 1st A, 7 Sep, pars 3b(1), (6).

they may be substituted...for the decision...above."[32] Two days later, on the 9th, Army modified the decision: "The infantry attack of the V Corps will be preceded by an artillery bombardment of 4 hours starting at H Hour, the infantry attack to start at H plus four hours on D Day."[33]

The argument for a preparation before H Hour appears in a rather remarkable document of 10 September, addressed to the Chief of Staff, First Army, by Lt. Col. W. S. Grant and Lt. Col. G. C. Marshall, Jr., staff members of G - 3.[34] They offered as their opinion that a 14-hour preparation should be made. Even though not executed, plans should at least be made so that if at the last minute it was deemed advisable, the preparation could be carried out. They offered nine reasons why an artillery preparation should precede the assault:

1. There was no instance in the war where an attack had been made against a highly organized position without an adequate artillery preparation.

2. To attack without preparation was taking a gambler's chance.

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32 Memo, Drum for Corps Comdrs, 7 Sep (US Army in the WW, Vol. 8, pp. 226 - 27.)

33 Ltr, CS 1st A to Corps Comdrs (except 1st Corps) & CofArty, 9 Sep (ibid., Vol. 8, p. 231).
Of interest is the revised arty annex to FO 14, 4th Corps, 8 Sep, (4th C Box 11, 32.1) which said corps arty would commence action at H Hour, discontinuing its long range gassing of enemy batteries at H plus 1. Divisional arty was to use gas as planned to mask places where the infantry didn't intend to cross, or to cross masked. Otherwise no gas within 4 hours of the time the place was to be occupied.

34 Memo in US Army in the WW, Vol. 8, pp. 232 - 33.

3. The preparation could do no harm and might make the operation easier by shaking the enemy's morale; it would cause breaches in the enemy's trenches and wire, put confidence in our troops, and put hostile batteries out of action.

4. A preparation would permit a certain amount of registration.

5. The preparation would serve as interdiction fire against enemy reinforcements and keep the enemy from altering his dispositions.

6. To omit the preparation would deprive Army of a powerful weapon.

7. The preparation would take the place of large tanks, which were not available, for cutting the enemy wire. There were not enough medium and small tanks on hand for the job.

8. The argument that the preparation should start at daylight to keep the location of batteries in the open concealed from the enemy was not valid. Army's superiority was too great for enemy batteries to interfere, and the batteries could be put in reasonably concealed localities for the preparation.

Finally, (it was actually the eighth argument offered):

Many areas such as woods, etc., should be drenched with gas before our troops are to pass through them, the gas bombardment on these places ceasing several hours before our troops arrive there. If there is no artillery preparation until H Hour we will be deprived of the use of gas on those localities where the necessity of gas is the greatest.

Colonel R. McCleave, Army G - 3, concurred in the memorandum, and in a letter that day, the 10th, to all corps commanders and to the Second and Eighth French Armies, the Army Chief of Staff ordered a four (not fourteen) hour preparation, beginning at H minus 4, by the three American corps.[35] Liggett's explanation of the final decision (pp. 64 - 65) throws only a little late light on the thinking in high places at the time:

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35 Ltr in US Army in the WW, Vol. 8, pp. 233 - 34.

In formulating the details of the battle, the question of time to be given to artillery preparation was decided by the known positions of the enemy's reserves in this region. It was calculated that four hours could be given to artillery preparation, because with our preponderance of artillery we could in this time do immense damage to the defensive organizations of the enemy, and still have sufficient leeway to permit our troops to reach the vital points in our advance before the enemy reserves could possibly intervene in sufficient strength to stop our movements.

At 4:30 p.m. on 11 September, with eight hours to go, notice was received by the 90th Division artillery commander of the final plans. The preparation with gas and HE that he intended appeared in a series of last minute operation orders.

Gas shell will be fired [by Heavy Artillery] from H-4 on targets occupied by personnel toward the rear of the zone of advance. The six battalions of 75-mm. that have been assigned the mission of creeping and protective barrage will fire gas shell from H-4h to H-2h on targets occupied by personnel. From H-2 to Hh, these same battalions [together with one battery of Heavy Artillery] will fire on the [1st and 2nd lines of] enemy wire....The allowance of ammunition for the operation will be two day's fire. As much of the gas will be fired as possible in order to leave high explosives for the later phases of the attack.[36]

A previous order that afternoon said:

Neutralization with gas of certain strongly fortified points will be attempted....The Heavy Artillery will attack, with gas shell, any of its targets occupied by personnel deemed by the regimental commanders to be too strong for destruction. Gas may be found particularly useful when adjustment is poor or entirely lacking. Expenditure of gas shell by the Heavy Artillery will not exceed on the first day, half of the supply at the positions. Gas will not be fired at targets west of a line 1,000 meters in advance of the 1st day's objective.[37]

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36 153rd FA Opns O 15, 11 Sep, Sub: Supplement to Arty Plans. See also draft opns memo, 153rd FA Brig for G - 3, 90th Div, 17 Sep (78th Div Box 25, 33.6).

37 153rd FA Opns O 13, 11 Sep, sub: Fire for Destruction and Neutralization. This is also Annex to par 3(d), FO 3, 90th Div (Box 6, 32.1).

The night of 11 - 12 September "was as black as ink and the rain was coming down in sheets." Nevertheless, at 1:00 a.m., the artillery opened fire and "for two hours all batteries fired nonpersistent gas into occupied areas in the Bois le Pretre and the rear of the main zone of advance. From H-2 to H, all fired H.E. on strong points, enemy wire and trenches...[with] the trench artillery all employed in the Bois le Pretre."[38]

The weight of HE fired by the divisional artillery is not known for certain, but in the first two hours 3,600 rounds of 75-mm. nonpersistent gas shell and 700 rounds of 155-mm. gas shell were put on the quarries west and southwest of Norroy, on Camp de la Source, Camp Grollman, Camp du Ravin, Tranchée Rhenane, and enemy shelters south of Tranchee Claude, with the greatest weight of gas shells, 2,000 75-mm. and 400 155-mm., directed on the quarries (Map No. 6).[39]

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38 Ltr, CG 90th Div to CG 1st C, 18 Sep, sub: Rpt of Opns beginning 12 Sep (90th Div Box 10, 33.6).

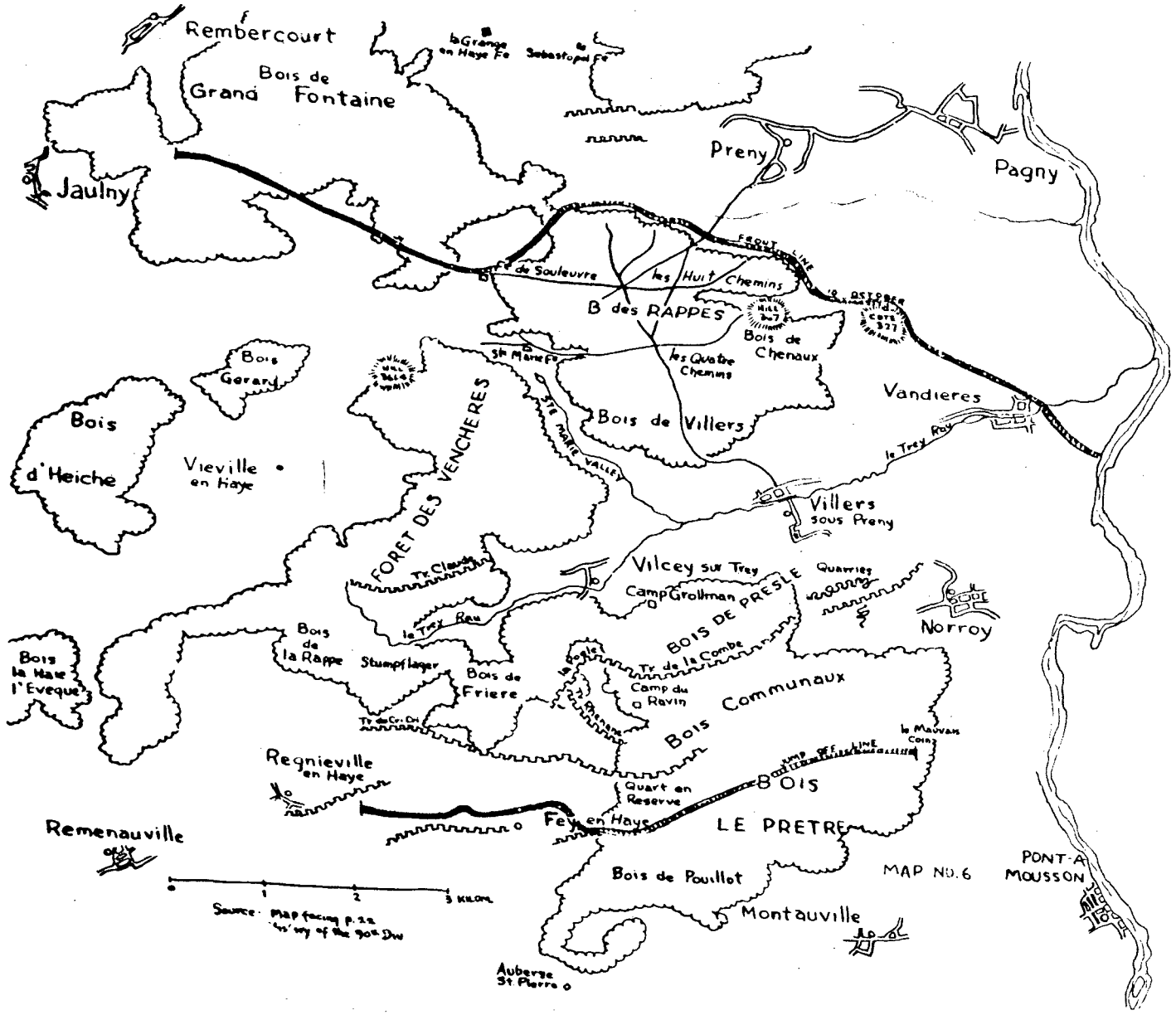
39 Opns Rpt, 153rd FA, 16 Sep, sub: Use of Gas in Off Opn (90th Div Box 87).

The enemy said of the gassings: "During this reorganization [i.e., the charge of positions by the 77th, involving the 255th] heavy artillery fire was launched on the positions and the rear area (Grollman Camp, Heine Camp, Ravine Camp, east and west exits of Villers, Bois de la Rappe). The Trey creek valley was heavily gassed" [WD 94th Ldw, 2:00 a.m., 12 Sep (255th Div-Sub Units-WD, German Files Box 232)]. The 153rd Ldw also rptd annihilation fire "mainly mixed with gas" and the gassing of the Trey valley; and though neither of these regts rptd casualties, the 68th Ldw rptd 2 killed, 4 wounded, and 3 gassed on Sep 12 [German Files Box 232, fol II, pp. 32, 122].

A draft memo, Opns O 153rd FA Brig for G - 3 90th Div, 17 Sep (78th Div Box 25, 33.6), indicates that between 5:00 a.m. and 6:00 p.m. on 12 Sep the 153rd FA fired 49,400 75-mm. shells (including 1,100 gas rounds); 8,500 155-mm. shells (including 500 gas rounds); 2,100 90-mm.; 1,800 95-mm. and 6,200 rounds by the trench artillery. This would appear to be total fire for the day, despite the hours given and the difference in gas shell total.

Of interest is FM 308th FA to 153rd FA Brig, 12 Sep (78th Div Box 24, 22.3 Intel Rpts):

Batteries A and C, 1st Bn, fired all their gas. Battery B did not fire gas as shells could not be distinguished in the dark. Battery commander of Battery relieved and sent to echelon....2nd Bn...gas shells fired before H-2h. No casualties in the regiment.


Rembercourt
Grand Bois de Fontaine
la Grange en Haye Fe
la Sebastopol Fe
Jaulny
Preny
Pagny
Tr de Souleuvre
les Huit Chemins
FRONT LINE
18 OCTOBER
B des RAPPES
Bois de Chenaux
les Quatre Chemins
Bois Gerard
Bois d'Heiche
Vieville en Haye
FORET DES VENCHERES
Ste Marie Fe
Ste Marie Valley
Bois de Villers
Vandieres
la Trey Rau
Villers sous Preny
Vilcey sur Trey
Camp Grollman
Quarries
BOIS DE PRESLE
Norroy
Tr Claude
la Trey Rau
Bois de la Rappe
Stumpflager
Bois de Friere
Tr de la Combe
Camp du Ravin
Bois Communaux
Bois la Haie l'Eveque
Tr de Cr. Or.
la Mauvais Coin
Regnieville en Haye
Quart en Reserve
BOIS LE PRETRE
Remenauville
Feye en Haye
Bois de Pouillot
Montauville
Auberge St Pierre
PONT-A-MOUSSON
MAP NO. 6
0 1 2 3 KILOM.
Source: Map facing p. 22 History of the 90th Div

The gas shells fired by the long range artillery of I Corps, otherwise unaccounted for in available records, appears from German reports to have been directed on the Vandières area, both during the preparation and again on the night of 12 - 13 September: "During the night the enemy continued shelling Vandières, the northwest position of the Vandières switch position, as well as Hill 327, using mustard gas."[40]

The division historian said of the bombardment:

> That artillery preparation was a wonderful thing [but] it may be doubted if all the firing, terrific as it was, did any material value [sic] on our front other than kill a few Germans. Certain[ly], it did not cut any wire. But the sound of the shells whizzing over their heads, and the sight of the flashes of bursting high explosives in Bocheland, cheered the shivering men in the strange trenches, and relieved the strain of the long wait for H Hour.[41]

The Salient is Closed

At 5:00 a.m. on 12 September, as the artillery preparation ended and the rain began to let up, the "two platoons of the 1st Gas Regiment executed

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40 1st Bn 68th Ldw WD, 13 Sep (255th Div-Sub Units-WD&A, German Files Box 232).

41 Wythe, p. 24. Elsewhere (p. 33) he says: "During the first two hours of this preparation, the artillery played on the back areas, principally with gas...but from 3 to 5 o'clock every available battery was directed on the enemy wire. However, this part of the program was not a great success ....[The effect was] practically nil."
90th Div records tend to contradict Shipley Thomas' statement (The History of the A.E.F., pp. 213 - 14): "Never before in the whole four years had infantry dared to assault until artillery had...cut the enemy wire. The American artillery, during the five hours preparation, had not played on the wire, but instead, had smothered the German batteries. The new scheme worked perfectly." In the four-hour preparation, only the first two hours of fire were directed on enemy batteries and rear areas, while subsequent fire was laid on the wire. This seems to have been true on the fronts of IV and I Corps, at least.

[their] smoke and gas offensive on the 90th Division front....Smoke screens by the 4-inch Stokes Mortars were followed closely by our infantry and furnished excellent cover, and undoubtedly saved many casualties. Stench gas and H. E. thrown over by the Livens projectors were effectual in causing the enemy to wear gas masks, the H. E. causing casualties in the first and second line trenches."[42]

Behind a creeping barrage of 18 batteries of 75s, the troops of the 90th Division advanced against the maze of wire and trenches, part of a 23-kilometer wave of men along the southern edge of the salient. General O'Neil of the 179th Brigade was to say: "The only obstacle was barbed wire, and there was enough of that to fence a Western cattle ranch.... [Past the wire] the fighting was carried on exactly as we fought in the Indian Wars....Very little attention was paid to attack formation by the front line. The squads seem to have kept in touch."[43]

General Allen agreed about the wire: "Practically no wire cutting was accomplished by the preparation or barrage....The great mass of wire

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42

Ltr, CG 90th Div to CG 1st C, 18 Sep, op cit. Note: The source of this portion of the report appears to be DGO ltr of 18 Sep.

There was some disagreement. Said the CO 3rd Bn, 358th Inf later: "Smoke barrage as promised not up. We crossed No Man's Land with no screen whatever between us and the enemy" (ltr to CO 358th Inf, 17 Sep, Tactical Lessons, 90th Div Box 24). But the CO 358th said: "Two four-inch trench mortars from 1st Gas Regt were in Fey en Haye to support the atk by placing a smoke barrage in front of the left assault battalion" (ltr to CG 90th Div, 20 Sep, Tactical Lessons).

43

Ltr, CG 179th Brig to CG 90th Div, 17 Sep, Rpt on Recent Opns (90th Div Box 18, 33.6).

....was cut almost entirely by hand."[44] Forehanded, the Texans and Oklahomans of the 90th had gone into the towns of Nancy and Toul earlier and openly bought 400 pairs of heavy duty, two-handed French wire cutters in the shops -- enough to provide cutters for four men in each platoon of the division. With them "they were able to cut a path thru the wire approximately as fast as a wave could walk and the infantry was stopped only a very short time by entanglements."[45]

Surprised by the attack, the 77th Reserve Division, west of the Bois de Friere, retreated in a rout before the attack battalion of the 357th Infantry and the assault waves of the 5th Division to its left. On the right, the 255th Division defended for a time its positions in the Bois de Friere and Quart en Reserve and then fell back as its supporting artillery opened fire with gas on the advancing forces.[46]

Less successful, according to Wythe (p. 44), was the 360th Infantry, just west of the Moselle:

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44 Ltr, CG 90th Div to CG 1st C, 18 Sep, sub: Lessons from Recent Opns (90th Div Box 10, 33.6).

45 Memo, G - 1 for CG 180th Brig, 11 Sep (Box 1, 10.2); Notes on Recent Opns, 5 Oct (Box 6, 32.5).

When these wire cutters were, with considerable reluctance, turned in for use in the Meuse-Argonne operation, the 90th Div promptly acquired 400 pairs of German wire cutters. See Memo, 90th Div Hq to each regt, 20 Sep, and note on memo 3rd C for Div Comdrs, 25 Oct (Box 11, 42.7-Wire Cutters).

46 "During the entire morning there was heavy shelling with gas shells from the Bois de la Rappe to the Quart en Reserve" (SOI 20, 12 Sep). FM Ruckman, ADC to CG 179th, 6 hr, 12 Sep (Box 18, 32.16): "I am being shelled by gas shell from behind."

The gas troops that had been provided...[had] promised to drive the garrisons...[from the Norroy quarries in the Bois le Pretre]. But subsequent investigation showed that the [heavy] artillery [preparation on these positions] had been unable to make an impression on the German defenses, which included mined dugouts forty feet deep [and] the gassing program fell through...[when] the first projector touched off blew up, killing the lieutenant in charge and many of his men.

The commander of the 360th reported otherwise: "The quarries immediately in front of the 3rd Battalion and the Norroy Quarries were heavily shelled with gas and high explosives. They were also heavily gassed [with skunk gas] by projectors, and a smoke screen was thrown over them by smoke generators....the only opposition encountered was machine guns that had escaped the effect of the barrage." The battalion was on the objective in less than two hours after the attack started and "The positions were organized under severe minenwerfer fire and shelling with gas, but all were held." The task of mopping up the Bois le Pretre and the quarries in the vicinity of Norroy was left for the next day.[47]

By 2:30 p.m., with the 179th Brigade in Vilcey, three kilometers from the jump-off line, the division reported that it had reached the day's objectives all along the line and support elements were mopping up the enemy positions that had been overrun. It was estimated at noon that 20 men had been killed and 20 officers and 400 men wounded in the morning's fighting.[48] What gas casualties there were in the 180th Brigade on the

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47 Memo, Price, CO 360th Inf for Brig Comdr, 21 Sep (90th Div Box 25, 33.6).

As the DGO said: "Two of the four projector emplacements were fired successfully and in the other two 73 projectors out of 150 were sent over, the balance failing on account of casualties among the men operating the show and due to poor equipment"(Ltr, DGO to C CWS, 20 Sep, sub: Smoke Screens vs MG Nests).

48 DOR 20, 11 - 12 Sep. The 179th Brig, however, rptd its losses as over 600 at noon, in Opns Rpt 1, 11 - 12 Sep (90th Div Box 17, 33.1).

12th "resulted mostly from men, while advancing falling, for protection, in shell holes contaminated with Gas."[49]

Everywhere, the overruning of the St. Mihiel salient had proceeded ahead of schedule. As von Ledebur, Chief of Staff of Army Unit C, later said, "supported by gas," the preparatory artillery fire fell on Group Gorze at a most unfavorable moment, when its 10th and 77th Divisions, with their artillery, were moving back during the night to a new line of resistance. Contrary to orders, the 77th had left two-thirds of its infantry in the old positions, without support, as the rest of the division moved back. Without artillery, the infantry of the 77th were overrun in the attack, and by 11:00 a.m., Vieville and Thiaucourt had been taken (Map No. 3).

Outflanked, the 10th Division, holding north of St. Baussant, broke and slowly retreated. The right wing of the 255th Division (opposite the 90th Division), endangered by the retreat of the 77th, was hard hit but for a time its center and left held. Learning of the rout of the 77th for the first time at 11:15 a.m., the German command at once ordered counterattack regiments of the 31st and 123rd Divisions, in reserve below Metz, rushed to the breach at Thiaucourt. Shortly after, the 107th Division too was on its way, to prevent a breakthrough on the Group Combres front.[50]

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49 Ltr, RGO 359th Inf to DGO, 27 Sep, sub: Gas (90th Div Box 87).

50 Maj Gen Baron Otto von Ledebur, in As They Saw Us, pp. 196 - 203. Detailed documentation will be found in translated opns documents, Army Det C, German Files Boxes 106 - 08. A summary of Gen Fuchs' report on the St. Mihiel Opn appears in MS Hist of 89th pp. 127 - 42 (89th Div Box 1, 11.4).

At noon, General Fuchs of Army Unit C, not Gallwitz, made the decision to withdraw from the salient, when he signalled to Group Mihiel: "Loki movement to be started immediately." By 1:00 p.m., fragments of the 77th were streaming north of Thiaucourt and the right wing of the 35th Division of Group Combres had been broken through. At 3:30 p.m., however, the advance above Thiaucourt had been checked with the arrival of the 31st Division at Jaulny and the 123rd east of the Rupt de Mad. To the right, the 255th "slowly pressed the Americans [5th Division] back in the direction of Vieville," and on the west face of the salient, the 35th Division was holding its own.

Covered by Group Combres, Group Mihiel began its retreat to the Michel Stellung that afternoon, marching 30 kilometers through the night to reach the St. Benoit crossroads before the American 1st Division could cut the line of retreat. At 6:00 p.m., Group Combres was ordered to Michel, and at 10:00 p.m., Group Gorze began to pull back to the fortified line. On the morning of the 13th, Groups Gorze and Mihiel were in position behind the line and Group Combres was at the approaches. Von Ledebur, ignoring the fact that the Allied forces had halted on order on the Army Objective,[51] said of the disengagement: "The enemy ceased battle quite early, apparently satisfied with the capture of approximately 15,000

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51 See Pétain's ltr to Pershing, 13 Sep, on limit of advance, cited by Gen Eugene Savatier, ACofGS, French Army, in As They Saw Us, pp. 288 - 89, 292.

prisoners and the considerable booty of 400 guns and other war material."[52]

On the evening of the 12th, with all forces on Army's second-day objective, I Corps reported that the enemy had been "thoroughly defeated on the whole front." The new positions were to be organized for permanent occupancy, with an outpost line secured two kilometers to the front by morning of the 13th.[53] Army, suddenly aware of its opportunity, at once ordered IV and V Corps forces to continue the pursuit and join that night in the vicinity of Vigneulles, thus closing the eastern exit of the salient and preventing escape of the retreating enemy.[54] But the troops had halted on the objective, the order was delayed, and at 7:00 a.m. on the 13th, when the 26th and 1st Divisions met at Vigneulles, between forty and fifty thousand Germar troops had cleared the exit.

On the morning of the 13th, the 90th Division resumed the assault. The attack battalion of the 357th Infantry advanced and almost at once met the 106th Saxon Reserve, 123rd Division, moving down from Grange en Haye Ferme to counterattack the 5th Division above Vieville. As a result of the ensuing fire fight, the 357th was held to a half kilometer gain that

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52 Ibid., pp. 204 - 11; Wythe, p. 26. For its utter failure in the atk, "His Majesty...ordered dissolution of the 77th Res Div," its regts going to the 10th and 26th Divs (77th Res Div WD&A, 23 Sep [ref 1036, WD&A, 11 Jul - 23 Sep, fol. I, p. 6, German Files Box 201]).

53 FO 51, 1st C, 12 Sep. That day the 5th Div had taken Vieville, the 2nd Div had entered Thiaucourt.

54 FO 10, 1st A, 12 Sep.

day, digging in along the railway running NW-SE through the Foret des Vencheres.

The 358th Infantry traversed the Vilcey sur Trey Valley and encountered only slight resistance in Vencheres Forest. By the morning of the 14th, it was through the woods and in position along the north edge overlooking the Ste. Marie Valley. To its right, elements of the 359th Infantry succeeded early on the 14th in setting up outposts overlooking the Vilcey-Villers Valley.

The greatest advance on the 13th was made by the 360th Infantry, which had moved up slightly the day before but that day captured the Bois le Pretre, where the French were said to have lost 123,000 men in 1915 attempting to wrest it from the Germans. After preparation with gas and HE on Camp de la Clef and the Norroy quarries by a battalion of howitzers,[55] two battalions of the 360th advanced from the Route de Bois Communaux through the forest and by 5:00 p.m. had succeeded in occupying and mopping up the quarries.[56] Total casualties as of the second day were reported as 2 officers and 50 men killed, 32 officers and 688 men wounded. No gas casualties

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55

"9:00 h to 9:30 h quarries west of Norroy and...north of le Mauvais Coin will be gassed by the heavy artillery" (Opns Memo, 180th Brig, 13 Sep). "This was approved and is being done. The rear of the 359th was not well mopped up yesterday" (Note appended to Opns Memo above, Gen Allen to CofS 1st C, 1055 hr, 13 Sep).

"Destruction fire, gas and HE, 155mm, at 9h45" (intel Rpt, 153rd FA Brig, 12 - 13 Sep [78th Div Box 24, 22.3]).

56

Wythe, pp. 42 - 45. A rpt at 6:30 that evening said: "Gas in the Norroy quarries prevented our troops from working" (Intel Rpt, 153rd FA Brig, above).

were reported.

On the 13th, as on the previous day, the 90th Division reported scattered, intermittent HE fire "with a little mustard gas."[57] The Division Gas Officer, however, said that beginning at 6:00 that morning and lasting until 3:00 p.m., between 600 and 760 blue cross and green cross shells (diphenylchlorarsine and diphosgene) had fallen along the division front from two kilometers northwest of Fey en Haye to Pont à Mousson, scattered over a ten-square-mile area (Map No. 7). This was "no concerted gas attack, merely the normal percentage of gas shells on all targets on which H. E. was thrown by the enemy."

Though wide spread and spaced over a nine-hour period, the gas shells reportedly produced a total of 104 casualties in the four regiments as the troops, numbed by rain and cold, failed to adjust their masks in time or remained in gas concentrations in the shell holes.[58]

At 10:00 o'clock on the 13th and continuing until noon on the 14th, an estimated 200 rounds of blue, green, and yellow cross shell fell on the front from west of Vilcey to Norroy. A division message said: "Boche shelling line 373.5-237.4 east along 239 [in the Bois Communaux] with

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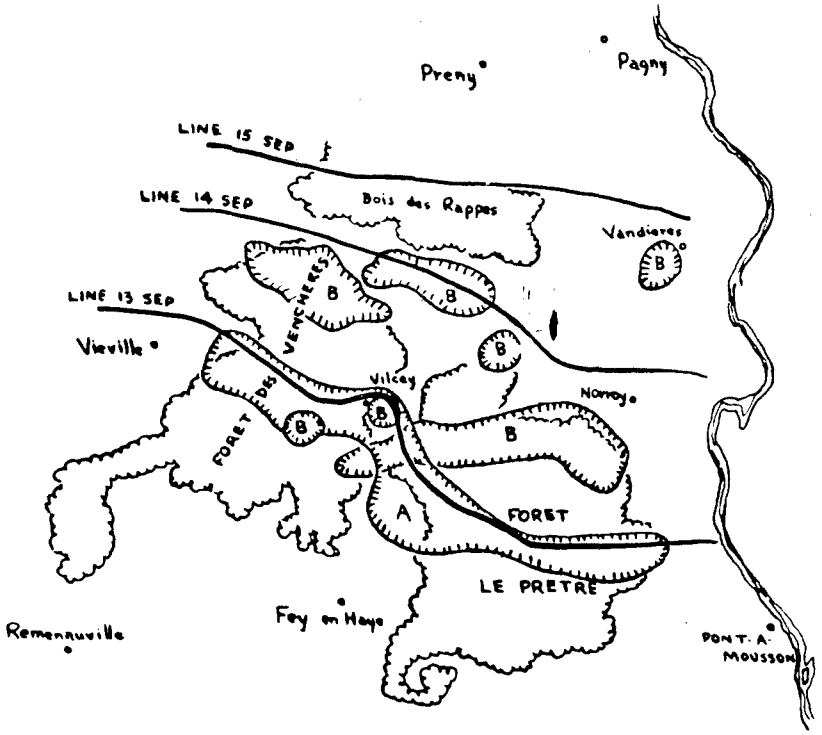
57 DOR 21, 22, 12 - 14 Sep; SOI 21, 13 Sep.

58 DGO Rpt on Gas Atk on 13 Sep: "The majority of the men stated they couldn't get their masks on quickly as they had been out all night in the rain and they were so cold they couldn't use their fingers, and their mask carriers were stiff and the masks wet. All are satisfied of the value of their masks and wore them even after they felt the effects of the gas." See also Spencer, III, pp. 557 - 60, and Division Surgeon data in Analysis, below.



A. Area gassed 13 Sep
B. Areas gassed 13-14 Sep

Source: Maps in GAF-90th Div & Spencer, Pt. IV

MAP NO. 7

Mustard gas - H.E. - shells coming from Bois de la Rappe [Bois des Rappes?].". "There was considerable harassing fire on the Norroy Quarries with a large percentage of gas shell, mostly blue cross. From 1200-2050 ...harassing fire...between the hill SE of Vilcey and Fey en Haye, especially...in the Bois de Friere, with a large proportion of gas shells in the woods."[59] Despite the division report, yellow cross predominated in the shelling, setting up a mild but persistent concentration that produced 143 casualties among the four regiments, of which two men were eye cases, the remainder becoming lung casualties when the men removed their masks too soon, unaware of the cumulative action of mustard gas in almost undetectable concentrations.[60]

The division order on the morning of the 14th, to continue the exploitation with the 5th and 82nd Divisions to a new line of resistance in front of the Hindenburg Line, was rescinded on corps order that afternoon and the main body of troops was recalled to the line of resistance fixed the night before, below Vilcey and on the heights west of Norroy.[61] The enemy line, reported that morning along Hanido Woods-Ste. Marie Ferme-southern part of Bois de Villers-Coté 327, was approximately the outpost

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59 FM 106 90th Div, 2120, 13 Sep (Box 7, 32.16). SOI 23, 15 Sep.

60 DGO Rpt on Gas Atk, 13 - 14 Sep; Spencer, III. 561 - 62.

61 FO 4, 90th Div, 9 hr, 14 Sep; FO 5, 16.15 hr, 14 Sep. Opns Rpt 3, 179th Brig, 13 - 14 Sep, says patrols remained at les Huit Chemins and in Vilcey.

line directed by Corps.

Sometime on the 14th, General Allen wrote in his diary: "We are still engaged in combat on various parts of the front, especially in view of the fact that we are trying to feel out the Hindenburg Line. Our casualties have footed up to about 973 battle and 158 gassed. Many of the latter are very slight. The number killed is about 60, but this may be increased, as that seems inordinately small for the wounded."[62] The 360th Infantry was ordered to organize its outpost position along Coté 327 Bois Chenaux, the 359th Infantry to continue the line to the left through Hill 367.8 in the Bois des Rappes. These positions -- said to be almost four kilometers beyond the 82nd Division to the right -- were reached on the morning of the 15th. In the left sector, with the main enemy body now back of the Michel Stellung, the 357th and 358th Infantry began organization of their new outpost positions above Ste. Marie Ferme, mopping up machine gun nests and isolated rear guards on the 15th and capturing Souleuvre Ferme on the 16th.[63]

As on the two previous days, mixed gas and HE shell fell along the advancing divisional front. "The valley of the Trey," the 360th Infantry said, "was filled with gas by hostile bombardment, and the advance through

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62 Fragment of General Allen's Diary, Sat, 14 Sep (90th Div Box 10, 33.3). Total casualties rptd in DOR 23, 14 - 15 Sep, were 53 officers and 1,241 men killed and wounded, including 9 officers and 192 men rptd as gas casualties.

63 SOI 22, 14 Sep; Wythe, pp 46 - 50. SOI 23, 15 Sep, rptd outposts from south of La Souleuvre Fme-les Huit Chemins-Coté 327-Vandières.

the valley and up the hill to the north [i.e., Côte 327] was made with gas masks on. There were numerous casualties."[64] That evening the 358th Infantry signalled:

> Gas shells falling fast. Send a barrage (FM Lt Tway to Lt Fry RIO, 1703, 14 Sep, 90th Div Box 22, 32.16).
>
> Advancing slowly, casualties heavy. Gas heavy in spots, tear and mustard. Several gas casualties. Artillery light barrage on top hill would rout Gas guns (FM Tway, 1747, 14 Sep, 90th Div Box 7, 32.16).
>
> Enemy shelling our troops with high explosive and tear and mustard gas. Casualties heavy....sixty casualties on front (FM Tell 6 [Fry, RIO] to Tyson 6, 1845, 14 Sep, Box 22, 32.16).

Engaged in reversing captured German trenches and stringing wire, a company of Engineers "found that the Germans still had guns that could reach the forward slope above Vilcey. There were four gas cases that night, but fortunately all light and no one ran into the H.E. A new 100-yard record was established however in getting out of the gas in the valley and with masks on at that."[65] There was no gas attack report for the 14th, but medical and gas records indicate that 35 gas casualties were brought in that day and over 150 the next day.

Reconnaissance patrols probing the Hindenburg Line near Preny and Pagny on the 15th found the enemy positions bristling with machine guns and waiting riflemen.[66] That same day, enemy long range guns east of the

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64 Memo, CO 360th Inf for Brig Comdr, 21 Sep (90th Div Box 25, 33.6).

65 Hist of Co C, 315th Eng (90th Div Box 28, 11.4).

66 SOI 23, 15 Sep, identified the enemy units opposite as the 178th, 351st, and 106th Res (123rd Div) and the 153rd, 94th Ldw, and 68th Ldw (255th Div.)

On 24 Sep, per SOI 32, the 178th and 153rd Regts were rptd withdrawn. On 4 Oct, per SOI 42, the order of battle from left to right was rptd as the 70th Regt (31st Div), the 351st, 178th, 106th Inf (123rd Div), and the 68th Ldw, 153rd Ldw, and 94th Ldw (255th Div).

Moselle opened fire with HE and gas on the southeast edge of the Bois de Villers, the southeast edge of the Bois des Vencheres, and on Villers and Vilcey. Unable to reach these enfilading batteries, the divisional artillery retaliated with long range harassing fire, including gas, on the Hindenburg line to the front. The St. Mihiel operation was over and the period of consolidation and stabilization. to last from 16 September to 10 October, had begun (Map No. 8).

Enemy materiel captured by the 90th Division was relatively small, but of interest was the Division Gas Officer's report of finding "a dump containing 550 Yellow Cross I, 105 caliber shells complete with propelling charges." These, he said, "will be returned to the Boche by some of the 105 guns captured if proper authority can be obtained."[67] There is no record that the authority was granted.

A final summary of 90th Division battle casualties reported 11 officers and 220 men killed, with wounded passing through the hospital triage totaling 57 officers and 1,463 men, including 508 gas cases, as well as "several Boche brought in badly burned from our mustard gas."[68]

67

Ltr, DGO to C CWS, 17 Sep, above. A total of 450 77-mm. gas shells and 1,280 105-mm. gas shells, along with 10 guns and howitzers, was rptd captured by the 90th at St. Mihiel. Memo, ACofS G - 1 to G - 3, 14 Nov, sub: Rpt of Captured Material (90th Div Box 3, 16.1).

Note: Yellow Cross I, a new shell early in 1918, was a superior green cross or phosgene gas (ethyldichlorarsine and dichlormethyl ether) filled only in the 10.5 cm. shell. It was later designated Green Cross 3 to avoid confusion.

68

Rpt of Opns, G - 1, 11 - 17 Sep (90th Div Box 2, 11.2); ltr, CG 90th Div to CG 1st C, 18 Sep, sub: Rpt on Opns beginning 12 Sep (Box 10, 33.6); ltr, DGO to C CWS, 17 Sep, sub: Gas Casualties (Box 87).

While Major Hunt came to consider the gas experience of the division in the stabilization period unusual and difficult, he seems not to have been aware that the number of gas casualties sustained by the 90th Division during the operation had been unique. By contrast, the other divisions that participated in the St. Mihiel campaign took relatively few gas casualties. The 1st Division, for example, was to report 23 gas casualties, with 72 delayed cases; the 42nd Division had 32; the 89th Division had 17; the 2nd Division reported 66, with 47 delayed cases; and the 5th Division, alongside the 90th, reported 65 gas casualties, with 194 delayed cases.[69]

Gas Alley

On 16 September, in preparation for the Argonne attack, II Colonial Corps took over V Corps front and two days later IV Corps took over I Corps front, with the 78th and 90th Divisions transferred to IV Corps. The 2nd and 5th Divisions were relieved by the 78th on the nights of 15 - 16 and 16 - 17 September, and by the 20th, the 69th French Division had completed the relief of the 82nd Division, the 90th taking over the sector previously held by the 82nd west of the Moselle and extending its outpost line to north of Vandières.[70]

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69 Series of gas charts in WD Hist Box 49.

70 FOs 53, 54, 56, 1st C, 14 - 16 Sep; FO 13, 1st A, 14 Sep. Between 16 - 26 Sep, almost 400,000 men were moved from the St. Mihiel to the Argonne sector.

During the weeks of consolidation that followed, the infantry and engineers of the 90th were engaged in rebuilding the roads in their sector and strengthening the main line of resistance. Almost nightly, patrols and raids were carried out against [illegible]my lines, to keep him off balance, with occasional fire fights occurring as enemy forces in company and battalion strength counterattacked outpost positions lost in the retreat. So that all might share in the hardships and all receive rest and retraining, the battalions rotated between the outpost line, the main line of resistance, and reserve, with one battalion in each brigade going back each week to divisional reserve at Griscourt to clean up and retrain, particularly in gas defense, with "sufficient close order drill to restore strict discipline and smartness of set-up and demeanor."[71]

The divisions left to hold the sector were, as the 90th Division later said, to find the period of stabilization "most trying." The enemy had withdrawn to pre-arranged positions and was to harass continuously the "front lines...with gas concentrations and shell of all calibers, particularly with enfilading fire from positions [on the heights of Vittonville] east of the Moselle."[72] Counterbattery fire by the divisional artillery could not still it and as a result one sector in particular, the ravine between Vilcey and Villers, through which all transportation passed, became

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71 Memo, G - 3, 21 Sep (90th Div Box 12, 50.1; see also opn'l memos in 90th Div Box 6, 32.15).

72 Rpt of St Mihiel Opn, 12 - 15 Sep (90th Div Box 5, 22.2); Capt T. S. Smith, Opns O, History of the 357th Inf, p. 4 (Box 19, 11.4).

known as Death Valley.[73]

The 90th Division, without prior experience of gas, had been gradually initiated during its three weeks of waiting for D Day. Somehow, despite almost daily harassing fire with gas, it had taken few casualties. But in the operation, in contrast to the gas experience of the other American divisions, the 90th had taken over 500 gas casualties. Unlike almost everywhere else along the St. Mihiel salient, the enemy before the 90th Division had not had to retreat very far nor very fast, and as a result he was ready to strike back almost at once after reaching the Michel Stellung.

The Division Gas Officer, Major Hunt, was later to say that "The fact that the men were not familiar with the smell of H.E. and mistook H.E. for gas and gas for H.E....had its bad effects. It is interesting to note that the Boche have thrown no gas into our rear areas, nor in fact into any position in the rear of our line of resistance."[74] He went on to say that the Germans were aware that the 90th was a new division on the front and therefore resorted to the familiar tactics of firing frequent small bursts of mixed gas and HE, to break down gas discipline. In adjacent sectors

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73 The kitchens of the 358th Inf, in the SW corner of the Bois de Villers, and of the 359th Inf, in the Bois de Chenaux, both places well known to the German artillery, were "constantly shelled, especially with gas" through most of the period (Wythe, p. 57).

74 Ltr, DGO to C CWS, 27 Sep, subj: German Tactics in Use of Gas (90th Div Box 87). Major Hunt's gas map (see Overlay to Map No. 4) tends to contradict his last statement.

with experienced troops, he said, they were getting real gas attacks.[75]

Beginning on 15 September, when the 90th Division had settled in to hold the sector, and ending on 10 October, when the division was relieved, it was subjected to an unvarying formula of daily harassing fire with gas and HE.[76] Between 500 and 2,500 rounds were fired each day into the sector, with apparently a fixed percentage of gas in each day's fire. Typical was a statement of the 358th Infantry RIO on the 17th:

> Battery in the direction of 372.0-245.0 has the area to the right and left of les Huit Chemins, firing directed by airplanes. He fires usually from dawn to 8h00, from 12h00 to 15h00 and from 18hr to dusk, inflicting several casualties each day. The shells being 77mm, mustard and phosgene shells, apparently the same plane directs this fire every day....Practically all of our casualties since the drive stopped have been caused from this airplane work.[77]

The Division Gas Officer, unable to report obvious gas bombardments, wrote up the enemy fire missions only on those days when the increased rate of fire resulted in a greater amount of gas shell than usual. As the Division said on 18 September: "There have been no heavy concentrations of gas

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75 The 78th Div, which came in beside the 90th on 17 Sept, was to report the same enemy gas tactics experienced by the 90th.

76 No 90th Div gas atk rpt has been found confirming execution of the following German arty order for a gas bombardment on the morning of the 15th: "During the early morning hours of 15.9 there will be a gas bombardment against Stumpflager and Bibrasruhlager [top of Bois de Friere]. Battery 118 will use its available yellow cross (340 rounds). Battery position 90 will use 800 green cross on Steiglager [south of Bibrasruhlager] and Battery 354 will use 360 green cross on our old position 1408 in its widest extent. Battery 90 with 120 yellow cross [and a heavy artillery battery] with 63 yellow cross [will fire] on the Vilcey area. (There should be 500 rounds of yellow cross on the way for these batteries. Inform us of its arrival)." 255th Div Arty Command, WD 11:55 p.m., 14 Sep (German Files Box 233).

77 SOI 25, 358th Inf, 16 - 17 Sep (90th Div Box 21, 20.1).

since the beginning of the offensive; however, it is estimated that 40% of all shell used in harassing fire is gas."[78] Possibly explaining the failure of the gas shoot of the 15th (see footnote 78), an enemy order that same day stated: "With the improvement in the ammunition situation, the heavy shelling of enemy preparations for attack is now to be taken up with increased vigor. In particular the shelling with yellow cross is to be carried out against as many places as possible."[79] Both the severity of the daily fire and the percentage of yellow cross shell noticeably increased thereafter. As the Division Gas Officer said on 23 September: "No reliable or complete data is available on the number of shells used in this [incessant] harassing but an estimate based on a compilation of all data available and personal observation of the percentage of gas used by the Boche in fire, places the figure at between 600 and 750 gas shells per day, on targets scattered over 10 square miles."[80]

From the incomplete data in Summaries of Intelligence, it is estimated that a minimum of 26,800 shells fell on the division in harassing fire between 15 September and 10 October, of which approximately 6,180 were gas

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78 SOI 26, 18 Sep.

79 Army Order, 18 Sep (Item 650, Annexes to WD, Army Det C, German Files Box 107).

80 Ltr, DGO to C CWS, sub: Gas Attacks (90th Div Box 87).

shells.[81] The area occupied by the division was ribboned with ravines completely familiar to the enemy artillery, without vestige of protection, and ideal for gassing. The gas and HE targets were the same almost every day: the area from La Souleuvre Ferme to the south edge of the Bois des Vencheres, the Bois de Friere, the Vilcey-Fey en Haye road, the Ravin de Frière, and the area around the Norroy quarries. But the terrain most consistently kept under gas was the valley from Vandières to Vilcey and from Vilcey to Vielle. This became "Gas Alley," and at no time during the stay of the 90th was it entirely free from gas.[82]

Retaliation

The artillery commander, Brigadier General Hearn, seems to have been a strong advocate of the use of gas and to have been willing to fire all the gas shell he could get. His numerous instruction memoranda on the moving of crews and guns under gas attack, the handling of leaking gas shell, and the degree of gas discipline required of artillerymen indicate he understood his men's wariness concerning gas shell, but he insisted that

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81 Where number of shells is omitted in the SOIs but fire is reported as "heavy" or "severe," the arbitrary figure of 1,000 shells was used; where fire is reported as "considerable" or "usual," the figure of 500 was used.

82 Between 23 Sep - 2 Oct, the RIO 357th Inf, from his OP at 370.5-242.2 [i.e., 1¼ km N of Ste. Marie Fme] rptd 10,515 HE rounds and 613 gas rounds in the Ste. Marie Valley and Vencheres Forest alone (this included a part of Gas Alley) (Daily SOIs, 357th Inf, 90th Div Box 19, 20.1).

The DGO was to rpt 107 gas casualties in the 357th Inf between these dates. No wound casualty data are available, but the division as a whole had 572 wounded in that period. See SG Chart, in Analysis.

with proper handling, firing gas shell was no more hazardous than HE.[83]

No gas shells were apparently fired by the 153rd FA Brigade prior to 12 September, but retaliation and neutralization of enemy batteries with gas were almost daily operations thereafter, even though not on the same scale as the German gas fire. Exact quantities could not be reported that first week, but "since the attack considerable quantities of gas shell have been used in harassing the enemy's circulating points by mixing gas and H.E. This has been done mostly by Heavy Artillery at long range around Pagny and the approaches to the Hindenburg Line."[84] Of the period, the Division Gas Officer was to say:

> During the interval between Sept. 12th and Sept. 26th no records are available of the exact number of gas shells used on targets. It is estimated about 200 gas shells per day were thrown over, #20 on cross-roads, villages, battery positions and occupied areas in the wood, and #4 and #5 on various targets such as cross-roads, batteries, dumps, kitchens, etc. The number of shells used has always been dependent on the ammunition available. The gas is nearly always mixed with HE.[85]

The first results of the retaliation fire in enemy records occur on 15 September, when two battalions of the 68th Landwehr reported losses

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83 See Instru Memos in 78th Div Box 24, 32.12.

84 Opns Rpt, 153rd FA, 16 Sep, sub: Use of Gas in Off Opn. Under 4th Corps, "10% of shell at gun positions of divisional arty and heavy arty of corps to be gas shell," per FO 30, 4th C, 21 Sep, Annex 3, par. VI.4 (4th C Box 11, 32.1).

85 Ltr, Maj Hunt, 6 Oct, quoted in ltr, Coulter DGO to C CWS, 12 Feb 1919, sub: Use of Gas Shell by American Arty (90th Div Box 87; ltr of 6 Oct in GAF - 90th Div).

(presumably since the 12th) of 1 officer and 4 men killed, 1 officer and 24 men wounded, and 1 officer and 21 men gassed.[86] On the 16th, the 106th Reserve Infantry reported gas fire in the early morning between Preny and Zugspitze (the draw east of Preny) and that evening the gassing of Pagny.[87] Again on the morning and afternoon of the 17th, the Germans reported gas and HE fire on their trench positions and on Pagny.[88]

It was probably German yellow cross rather than French Yperite that stopped three German patrols on the 17th:

> Two patrols of the 106th Reserve sent against Rappe wood. Mission: reconnaissance of enemy positions, capture of prisoners. NW edge of Rappe wood unoccupied. Beginning at 10:o'clock heavy artillery fire and gas on the edge of the wood from Souleuvre Farm to les Huit Chemins. Forced to put masks on. Could go no farther. 68th Ldw patrol from Vandieres position to Hill 218 also stopped by gas (Morn rpt, 82nd ldw Brig, 17 Sep [255th Div-Sub Units-WD, Box 232]).

And the next day: "Patrol of third company penetrated into Vandières but could not advance past village as our artillery was shelling the place with harassing fire and gas (WD 1st Bn 68th Ldw, 2:00 a.m., 18 Sep, op cit)." The German records indicate that retaliatory and harassing fire with gas continued daily from the 17th to the 20th, with gas targets in and around Preny and Pagny, the Sebastopol ravine north of Preny, and the trench and

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86 WDs 1st and 3rd Bns 68th Ldw, 15 Sep (255th Div-Sub Units-WD&A, 7 - 20 Sep. German Files Box 232, Folder II, pp. 64, 82).

87 Morn Rpt, 82nd Ldw Brig WD, 3:35 a.m., 16 Sep (255th Div-Sub Units-WD&A, Box 232, Folder II, p. 14); 255th Div WD, 16 Sep (255th Div WD&A, Box 232, Folder I, p. 4).

88 WD 68th Ldw, 17 Sep (255th Div-Sub Units-WD&A, Box 232, Folder II, p. 38).

outpost positions before the two towns.[89]

The fact that the Germans were daily firing three or four gas shells to each one fired by 90th Division artillery made General Hearn's complaint "that he couldn't get enough gas shells" a valid one. Nevertheless, the retaliation served to raise the spirits of the division. "The dread of enemy gas is so profound that the knowledge that we are using gas on the Boche increases the morale of our officers and men and causes general satisfaction throughout the division."[90]

The gas experience of the 90th Division on that front was, as it said, "trying," and near the end of its stay division headquarters was to make a heartfelt recommendations: "It is suggested that an endeavor be made to provide each battery at the close of an action with a plentiful supply of gas and that as soon as observation is obtained a plan of retaliation fire be put into effect. It is believed that a severe program of retaliation with high explosive and gas will assist materially in reducing the enemy's fire during the period of consolidation."[91] This would seem to

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89 See 82nd Ldw Brig morning & evening rpts in Box 232, Folder II, for the period.

90 Ltr, DGO to C CWS, 20 Sep, subs Smoke Screens vs MG Nests. One source of the "dread" may be reflected in the Army Det C Order of 26 Sep:

According to observations...the use of a few rounds of blue cross causes gas alarms and considerable unrest. The repeated firing of small blue cross surprise bombardments during the whole course of the night is therefore recommended.

Army Det C, WD&A, 20 Sep - 12 Nov (German Files Box 107, Folder I, p. 27).

91 Notes on Recent Operations, 5 Oct (90th Div Box 6, 32.15).

indicate that far too few of the 20,000 rounds of yperite reported by Schulz in I and IV Corps dumps on 13 September[92] were made available to the 90th Division for retaliatory fire. Except for the gas preparation on the 26th, the unequal duel was to continue in October.

Gas for a Demonstration

Simultaneously with the opening of the Meuse-Argonne offensive, First Army directed all divisions between the Meuse and Moselle to make demonstrations on their fronts. Prompted by a 90th Division raid in force beyond the outpost line on 23 September, and aware of the increased activity in the American lines, the enemy artillery stepped up its harassing fire and with it the gas shelling. Through the 24th and 25th, in addition to the mixed gas shelling in Gas Alley and in the ravine between the Bois de Frière and Bois de la Rappe, "there was considerable mustard gas [fired into] the Bois de Chenaux. It is estimated that over 1500 shells fell in the sector, of which at least 20% were gas and over 80% of this was mustard gas."[93]

The Division Gas Officer, reporting only the gassing of the Bois des Rappes (Bois de Chenaux?), two kilometers north of Villers, said that between 10:00 p.m. and midnight on the 24th, 150 mustard gas and phosgene

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92 See below, Analysis, p. 62.

93 SOI 33, 24 - 25 Sep. The 358th Inf said: "Enemy battery from NW fired mustard gas shells in sector throughout the day....At 19h00 about 60 gas shell fell in area in rear of Bois de Friere....Enemy arty very active, about 1200 shells falling in the entire sector, of which about 300 were gas shells, diphosgene and mustard" (SOI 34, 358th Inf, 25 Sep, Box 21, 20.1). See also ltr, RGO 358th Inf to DGO, 28 Sep, subj Weekly Rpt (90th Div Box 87).

shells fell among 250 men of the 358th Infantry on the patrol line in the woods. He reported three casualties. Further gassing of the front lines was reported during the day and on the night of the 25th, beginning at 9:20 p.m., apparently without causing any casualties.[94]

In the raid on 26 September against the Hindenburg Line, about 500 men from each of the brigades of the 90th took part, in conjunction with similar raiding parties sent out by the 69th French east of the Moselle and the 78th, 89th, and 42nd Divisions to the left.[95] The plan was to attack the German trenches due north of the Bois des Rappes, then wheel right towards Preny and Pagny and return through the enemy lines around those towns.

For six hours prior to the attack at 5:30 a.m., corps and divisional artillery harassed the communications lines and assembly points of the enemy with gas and high explosive. Beginning with a 15-minute surprise fire, the divisional 75's firod 500 rounds of yperite on enemy billets above Preny, 450 rounds of yperite on the town of Pagny, and 500 rounds of yperite on batteries in the Bois le Comte, while the heavy artillery put 300 rounds of cyanogen and phosgene (#4 and #5) on the town of

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94 Spencer, III. 563 - 64; Intel Rpt 153rd FA Brig (78th Div Box 24, 22.3).

95 FO 6, 90th Div, 13 hr, 25 Sep.

Arnaville (Map No. 9).[96]

While no reports of enemy casualties have been found immediately after the event, the yperite attack must have been extremely effective, for on 3 October the 68th Landwehr reported "6 delayed gas casualties from the yellow cross shoot of 26 Sept," and the next day reported "another 10 gas sick as a result of the 26 Sept gassing."[97]

The 358th and 360th Infantry reported that assembling near the top of the Bois des Rappes just before midnight, they saw enemy forces massed along the camouflaged road to their front as if preparing for a counterattack. Had the enemy known how thin the attack line was they would have advanced, "instead of contenting themselves with shelling the woods with high explosives and mustard gas. These woods, wet with daily rains, offered an excellent opportunity for the Germans to drench them with mustard gas, which they proceeded to take advantage of, so that many were sent to the hospital with burns of mustard gas or the effects of delayed action on the lungs."[98]

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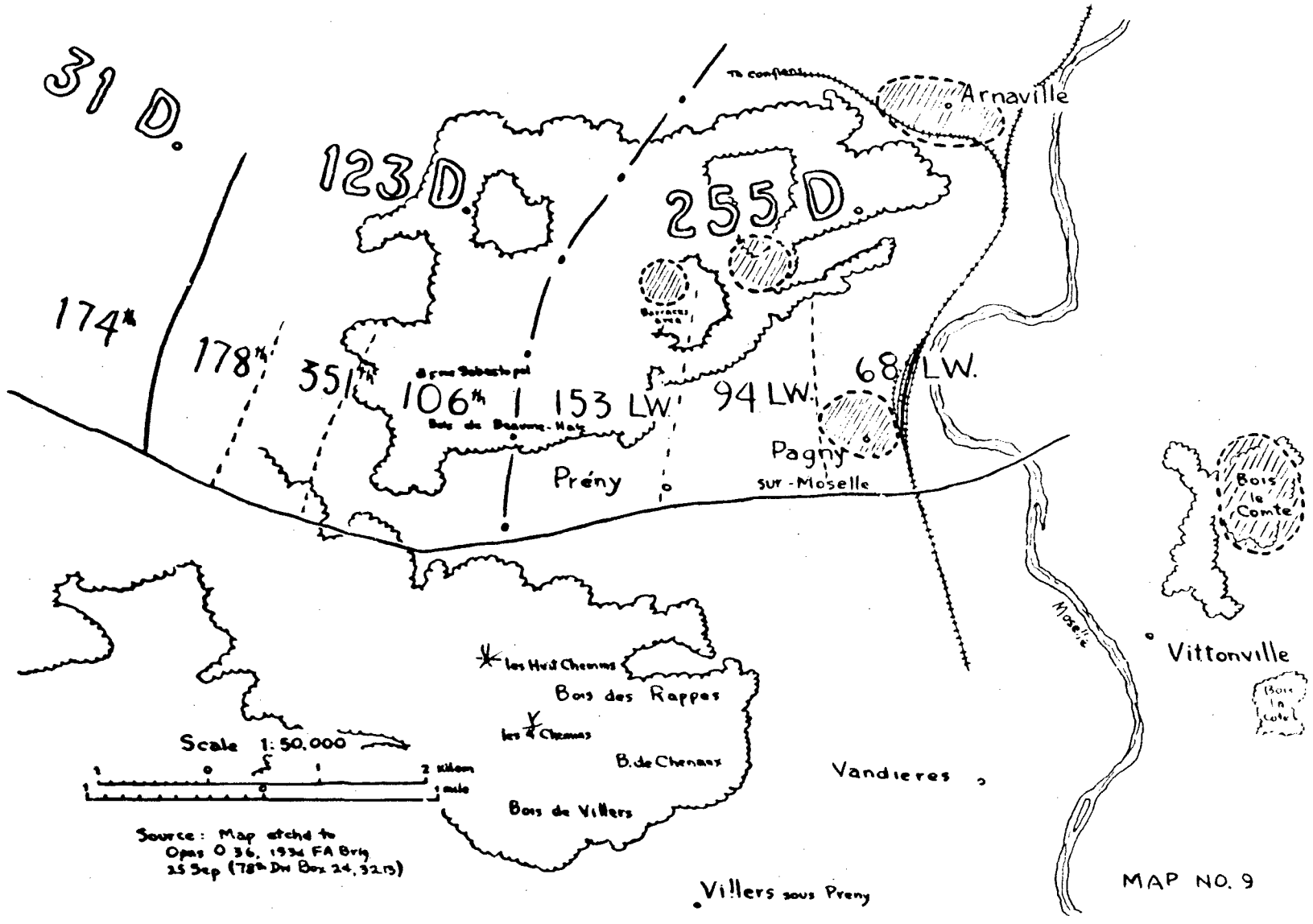
96 Opns O 36, 153rd FA Brig, 25 Sep (78th Div Box 24, 32.8); Memo, Opns O 153rd FA Brig to DGO, 1 Oct; ltr, DGO to C CWS, 12 Feb 19, subj Use of Gas Shell by Amer Arty (90th Div Box 87).

Opns O 12, 308th FA, 25 Sep (78th Div Box 27, 32.12), said the proportion would be one HE for each three gas shells, the gas mission to be fired between H minus 6 and H minus 5hr45. Thereafter all batteries would harass circulation points.

The CO 308th FA, reporting completion of the mission, commented, perhaps by way of critique: "An occasional shell or volley dropped with accuracy will accomplish much more than a world of ammunition fired merely upon map data" (memo to CG 153rd FA Brig, 27 Sep, 78th Div Box 27, 11.4).

97 68th Ldw WD (255th Div-Hq & Sub Units-WD&A, 1 Oct - 11 Nov, German Files Box 233, Folder II, pp. 2 - 3).

98 Capt T. P. Grant, History of the 358th Inf; Capt H. P. Breazeale, et al., History and Statistics of the 358th Inf, May 1919 (99 pp.), pp. II - 13 (90th Div Box 21, 11.4).


31 D.
123 D.
255 D.
174th
178th
351st
106th
153 LW.
94 LW.
68 LW.
Arnaville
Prény
Pagny
sur-Moselle
Bois de Beaume-Haie
Moselle
Vittonville
Bois le Comte
Bois la Côte
les Hts Chennes
Bois des Rappes
les 4 Chennes
B. de Chenaux
Bois de Villers
Vandieres
Villers sous Prony
Scale 1:50,000
2 kilom
mile
Source: Map atchd to
Opns O 36, 1934 FA Brig
25 Sep (78th Div Box 24, 32.13)

MAP NO. 9

At exactly 5:30 a.m. the German artillery anticipated the attack with a violent bombardment "from the north, northeast, and east" that fell directly on the assembled raiding parties. There is some question about what happened next. The division said that emerging from the Bois des Rappes, the raiders met a similar party from the 106th Infantry, 123rd Saxon Division, and after a hand to hand fight withdrew, having suffered almost 300 casualties, not counting those left in the enemy's hands. Some of the men were said to have got beyond the Bois des Rappes, but none who reached the trench system before Preny and Pagny returned to tell of it.[99]

So disastrous was the enemy counter fire and disorganization which followed that at 9:30 a.m. the raid was called off and the dead and wounded were left in the field. The troops were ordered to remain in the outpost position until night and then return to the main line of resistance. They came in at 9:00 that night.[100]

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GOI 34, 26 Sep; Wythe, pp. 59 - 62. This seems corroborated by a signal of the 106th Inf: "The attack...warded off....At 3:10 AM formed for a counterattack....The enemy retreated to the Bois des Rappes with apparent heavy losses. Up to now 20 machine guns captured and some 15 prisoners including 1 captain of the 359th Reg, 90th Div. Morale of the troops raised considerably by the success. A yellow cross bombardment of the Bois des Rappes is greatly to be desired" (Pigeon message, 106 IR, 10 a.m. 26 Sep [123rd Div-Sub Units-WD&A, 25 Sep - 24 Oct, German Files Box 212, Folder II, pp. 17 - 18]).

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Ltr, CO 2nd Bn 360th Inf to CO 360th, 27 Sep, sub: Opn night of 25 - 26 Sep (90th Div Box 25, 33.6).

Ltr, General Allen CG 90th Div to CG 4th C, 29 Sep, sub: Opn of 26 Sep (4th C Box 21, 33.6).

Of interest is the rpt of the RGO 359th Inf on 27 Sep: "We now have remaining in our Regimental Reserve only 6 respirators and the Second Bn of this Regiment which took part in the raid of Sept. 26 has suffered severe casualties and it will be necessary to have new masks to replace those lost in action" (ltr to DGO, 1 Box 87).

The Germans retaliated for the artillery preparation that morning by heavy shelling with gas all the afternoon and night of the 26th. Beginning at 2:00 p.m., "a heavy concentration of diphosgene...[fell] in the sub-sector held by the 358th Infantry, extending about 600 meters east and west from les Huit Chemins. It is estimated that over 2500 shells fell in the sector [this date]....There was the usual harassing fire in the valley from Vandières to Vilcey. In the harassing fire about 20% of gas shells were used."[101] Curiously, no reports of the gas attacks on either the morning or afternoon of the 26th have been found, although the Divisional Medical Gas Officer and Division Gas Officer both record 77 gas casualties that day.

On the 27th, the division recorded a total of 1,500 shells, with "the usual percentage of gas shell," around les Huit Chemins and the Vandières-Vilcey Valley, but the Division Gas Officer said that approximately 1,000 mustard gas and diphosgene shells alone fell between 1:00 and 2:00 a.m. and 5:00 and 6:00 a.m. that morning along the road in the Ste. Marie Valley, together with "a large amount of H.E." Almost 400 men were exposed, of which 62 became casualties, 42 with eye and body burns and 20 with lung complications, principally owing to poor gas discipline. The gassing had caught divisional kitchens on the move and many of the men went through the gassed area with only the mouthpieces of their masks

101 SOI 34, 26 Sep; FM McMichael (179th Brig) to Fade (156th Brig, 78th Div) 1530, 26 Sep (90th Div Box 18, 32.16).

adjusted.[102]

An incident of this gas bombardment seems to have escaped the Division Gas Officer. It was the Division Medical Gas Officer who later said:

> The only disaster inflicted by the enemy occurred in the early morning of Sept. 27, when he secured a direct hit with a di-phosgene shell on a dug-out in which our men were sleeping. The men were...evacuated...through a valley that had been previously shelled with mustard gas....All were severely burned [receiving] heavy concentrations of both gases. The prompt evacuation of the area and the prompt evacuation of the men to the gas hospital where they received heroic treatment no doubt saved the lives of many. There were 17 fatalities.[103]

Wythe in his history (p.63) says that as a result of the mustard gas concentration on the line of resistance of the 359th Infantry that morning, "The positions became so bad that it was necessary to move...into new ones. Owing to the persistence of this...gas, it was never possible to occupy the gas-saturated trenches again during the time that the Division remained in the Puvenelle sector." By the 27th, the incidence of troops becoming casualties while traversing previously and sometimes unsuspected contaminated terrain had become such a problem that special squads were ordered organized that day in division headquarters, each infantry regiment, in the artillery regiments, the engineer regiments, and the machine gun and mortar units, to locate and decontaminate all mustard gas sites in their areas,

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102 Rpt on Gas Atk of 27 Sep (Box 87); Spencer, III. 565. SOI 37, 29 Sep, said the DGO rptd 500 105-mm. mustard gas shells on the 27th, from Souleuvre Fme to Ste. Marie Fme and for 200 yards on either side of the valley. Casualties were 62.

103 Ltr, DMGO to Div Surg, 15 Nov, subj Final Report (Med Dept Box 3982, Folder 8).

bury gas shell duds, and continue these duties for the rest of the stay.[104]

On 28 September the division reported: "Instead of following his custom of the past several days of scattering gas shells through his harassing fire, the enemy has brought short and heavy concentrations on restricted areas. This may be retaliation for our fire of the same character on Preny and his camps and communications." In these small gas bombardments, "a considerable proportion of gas shells" had been fired into the Ste. Marie Valley and the wood west of the valley that day, as well as "a concentration of gas shell on the Camp de Norroy" in a twenty-minute burst at 3:30 a.m.[105]

At least 300 mustard gas shells fell along Trench de la Combe and along the Route de Bois Communal to the east slope of the valley east of La Poele between 1:00 - 4:00 a.m. on the 28th. A burst of gas shell at 3:30 a.m. along Trench de la Combe landed among the men of the 359th Infantry and 345th MG Battalion who had taken part in the raid two nights previously and were resting, exhausted and "demoralized with shrapnel and HE," in the trenches in these woods. Of almost 500 men there, 40 were burned and 10 became lung casualties, reportedly because they failed to

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104 Memo 221, G - 3, 27 Sep, sub: Mustard Gas (90th Div Box 13, 54.3).

105 SOI 36, 28 Sep. In his Diary for the 28th, General Allen said: "About 2500 shells fell on this sector during the past 24 hours and many of them contained mustard gas. This was probably in retaliation for my having 'epyrited' Pagny and Preny. Our gas casualties today have amounted to about 120" (90th Div Box 10, 33.3).

realize the danger of low concentrations of mustard gas (Map No. 10).[106]

As Major Hunt said:

The point most difficult to combat is the disregard for the presence of gas in mild concentrations. In a wooded area where the men are widely scattered, and where the gas hangs in pockets caused by scattered harassing fire with gas shells, the men have to take care of themselves without having the word of an officer to rely on, and their tendency is to be careless. The present tactics of the Boche...is having a decided effect, and it is difficult to impress upon the men and officers that there have been no real 'gas attacks,' with the exception of the Mustard and Diphosgene attacks reported for the 28th and 29th of the month.[107]

Continuing the program of retaliation, between noon and noon, 27 - 28 September, the divisional artillery fired 113 rounds of phosgene (#5) gas and 240 rounds of mixed #5 and HE on enemy batteries and on the town of Preny. On the afternoon of the 29th, 32 rounds of #5 were fired into the Pagny railroad yards. On 29 - 30 September, a total of 103 rounds of phosgene, 125 rounds of yperite, and 40 cyanogen gas rounds were fired on batteries and camps in the Preny-Pagny area. On the day following, 52 rounds of phosgene and yperite and 40 other gas rounds were fired at crossroads, and 32 rounds of cyanogen were placed on the Pagny yards.[108]

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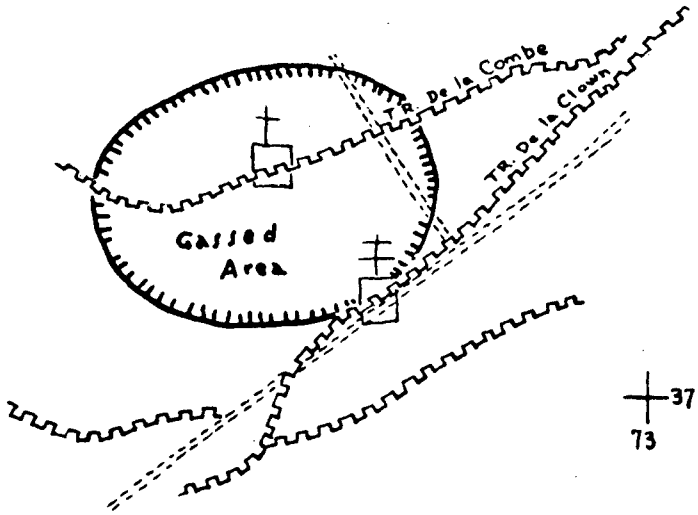
106 SOI 37, 29 Sep; RGO Rpt on Gas Atk of 28 Sep (Box 87); Spencer III. 566.

Opns Rpt 37, 90th Div, n-n 28 - 29 Sep, reported 1 killed, 15 wounded, and 64 gassed (90th Div Box 6, 32.1).

107 Ltr, DGO to C CWS, 30 Sep, Monthly Rpt (90th Div Box 87). No gas atk rpt for the 29th has been found, nor does the atk appear in Major Hunt's map showing the location of gas atks during the month of Sep (see Overlay with Map No. 4).

108 Opns Rpts 153rd FA Brig (78th Div Box 25, 33.1); ltr, DGO to C CWS, 6 Oct, subs Gas Shells Used by Our Arty during Sept (GAF-90th Div).

Of these missions, the 255th Div WD, 1 Oct, acknowledges only the last, the "bombardment with gas of Sebastopol Camp" (255th Div-Hq & Sub Units, 1 Oct - 11 Nov, German Files Box 232, Folder I, p. 1).



Sketch based on 1/10000 map atchd to Rpt of Gas Attack, 28 Sep, 359th Inf

Source: 90th Div Box 87-DGO

MAP No. 10

Of these gas rounds included in his daily fire missions, General Hearn said: "The purpose of this fire is to kill Boche in retaliation for the casualties he is causing us....In order to get maximum results this fire must be short, accurate and from all guns simultaneously. As soon as one shot falls the enemy will take cover, therefore the uselessness of continued firing. However just to greet him when he comes out again, gas will habitually be mixed with high explosive in this firing."[109]

The Gas Attack of 2 October

Perhaps the only gas attack on the 90th Division uncomplicated by HE shell occurred on 2 October. The German artillery war diary said that from 2:00 - 5:00 that morning "Our artillery contaminated the enemy positions in the Bois des Rappes with a total of 2800 rounds of yellow cross." From 3:30 - 11:00 p.m. that same day there was "a follow up gassing of the positions which were 'yperited' [vergelbten] in the night and morning with some 200 rounds."[110]

The 90th Division observed "considerable shelling with mustard gas on the front areas from Souleuvre Farm to Hill 367.8," adding later:

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109 Opns O 38, 153rd FA Brig, 30 Sep, subs Retaliation Fire (78th Div Box 24, 32.8). A schedule with this order indicated that a mission with 88 HE and 88 #4 shell was to be fired by the three regts on La Grange en Haye Fme, Preny, and the trenches between. A second schedule called for 450 yperite shells on La Grange Fme and nearby roads and 200 more on Bois la Coté and Bois la Compte, both schedules to be prepared at once and fired on call. There is no evidence that these precise missions were fired.

110 Arty Comd 255th Div WD, 2 Oct (255th Div-Hq & Sub Units-WD&A, 1 Oct - 1 Nov, German Files Box 233, Folder II, pp. 126 - 27). Total enemy ammo consumption that day was 4,217 rounds.

"During the night our front lines from Vandières to les Huit Chemins were shelled with mustard gas, also the front area in the Bois des Rappes. Between 16h00 and 20h00 there were 200 mustard gas shells on the front areas between les Huit Chemins and Hill 367.8. The enemy appears to be building up a concentration of mustard gas in this area.[111] The Division Gas Officer reported 200 mustard gas shells in the 2nd Battalion, 358th Infantry, area in the Bois des Rappes between 5:00 - 6:00 a.m. and over 620 more in the same area between 5:00 - 11:00 p.m. that night (Map No. 11).

All routes, trails, and command posts in the wood were thoroughly contaminated as "a large percentage of the shells burst in the tree tops and splattered large areas." Only 5 casualties were reported as a result of the morning attack, but evacuating their positions in the woods that night and unaware of the extent of the contamination, the men found it impossible to wear their masks and find their way through the thickets in the dark. The Battalion Gas Officer himself became a casualty from burns. Of 500 men exposed, the DGO reported 185 casualties, 60 per cent of them eye cases and surface burns, the remainder lung cases.[112]

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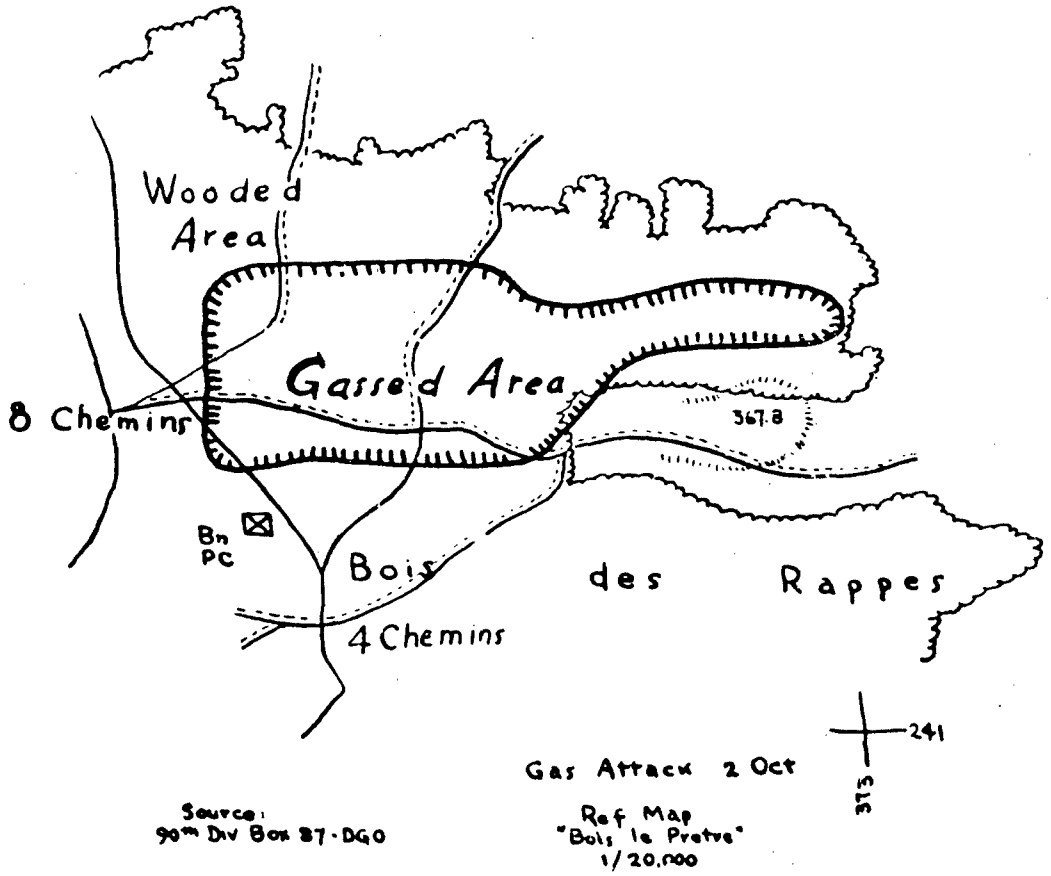
111 SOI 40, 41, 1 - 3 Oct. DOR 41, 2 - 3 Oct, rptd 2 killed and 6 wounded that day and 3 officers and 148 men gassed in the 358th Inf.

112 BGO, 2nd Bn 358th Inf, Rpt of Gas Atk, 2 Oct, and ltr, DGO to C CWS, 4 Oct, subs Rpt on Gas Atk (Box 87); Spencer, III. 568 - 69.

A battalion notice, issued sometime on the 2nd, said all company commanders were to see that their men used soap solution on their eyes, nose, and throat. The fresh supply of lime that was on the way would be used to disinfect the contaminated areas. Meanwhile, if the sun came out, men forced to stay in the gassed area were to put on their masks at once. They would be relieved as soon as feasible (memo, 2nd Bn, 2 Oct, 90th Div Box 87).


Wooded Area
Gassed Area
8 Chemins
367.8
Bn PC
Bois des Rappes
4 Chemins
241
313
Gas Attack 2 Oct
Source:
90th Div Box 87 - DGO
Ref Map
"Bois le Pretre"
1/20,000

MAP NO. 11

"The number of casualties resulting from this attack," said the DGO, "were beyond all reasonable numbers and a thorough investigation was made." He suspected malingering and not, apparently, 3,000 yellow cross shells. The Division Medical Gas Officer was later to deny there was any malingering in the 90th Division.

In his history, the adjutant of the 2nd Battalion, 358th Infantry later wrote:

> The violent mustard gas bombardment of the les Huit Chemins position on Oct. 2 - 3 was disastrous for the 2nd Bn. As a result of the Yperite attack, Companies E and F, who held the front line positions, [were] reduced to a fighting strength of about 59 men two days later when the organization was shifted to a new sector in front of Vieville-en-Haye. Existing conditions had prevented an evacuation of the les Huit Chemins position. Total evacuations on account of gas were 285.[113]

Less restrained was the account of the division historians:

> The effects of the gas were horrible beyond description, some being blinded for life, others being disfigured by the effects of the acid....In addition, practically every man in the battalion...was weakened by inhaling the fumes....The evil effects of this gas bombardment were felt even after the Division moved into the Meuse-Argonne sector. Regimental Surgeon Major Karl T. Brown claimed that the battalion was unfit for duty, and upon examination three officers and 130 men were evacuated as post-gas cases. This made a total of approximately 300 men...put out of action by the gas attack, not to mention many others...rendered unfit (Wythe, p. 58).

Final accounts in gas officer and medical records show totals of 285 and 297 gas casualties, respectively, between 2 October and 7 October, when the division left the sector. To these figures must be added the 133 delayed cases reported by the Regimental Surgeon and Division Medical Gas Officer, making total casualties as a result of this mustard gas attack between 418 and 430.

Retaliating for the enemy gas attack, the division at dawn on 2 October fired 469 rounds of yperite on the roads north of Preny, 100 rounds of unidentified gas into the Bois la Côte, 40 rounds of cyanogen on Pagny crossroads, 98 rounds of yperite and 26 unidentified gas shells on trenches and

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113 1st Lt R. Boylan, History of the 2nd Bn, 358th Inf, 24 Dec (90th Div Box 21, 11.5).

crossroads beyond the Moselle. A 94th Landwehr report said: "5:40-6:30 a.m. The enemy contaminated the Preny ravine with yellow cross. It was determined that there were slight gas casualties."[114]

Through the night of 2 - 3 October, 37 rounds of yperite and 56 other gas rounds were fired with HE on enemy crossroads and shelters and 100 large-caliber yperite shells and 135 additional gas rounds were put on Preny and Arnaville. On 3 - 4 October, in its last fire missions, the 153rd FA Brigade fired 66 rounds of yperite, phosgene, and cyanogen on those same enemy targets to the north and east.[115] The 153rd Landwehr said of the gassing on the night of 2 October: "9:30 - 10:30 p.m. Lively gas bombardment of Preny, the Pagny-Sebastopol road and the ravine north of Preny (about 1000 rounds). In between there were single H.E. rounds."[116]

Nowhere reported by the 90th Division was the gas attack on the morning of 3 October. On the 2nd, a 255th Division order for the artillery said that "If the weather is favorable for sudden gas attacks, upon investigation of the Artillery Commander, there will be a repeat gassing of the same targets as the night of 1/2 October." The next day, the artillery reported:

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114 3rd Bn 94th Inf WD, 2 Oct (255th Div-Hq & Sub Units, 1 Oct - 11 Nov, German Files Box 233, Folder II, p. 88). Also rptd in 68th Ldw WD, 2 Oct, ibid, pp. 60 - 61.

115 Opns Rpts, 153rd FA (78th Div Box 25, 33.1). CF ltr DGO to C CWS, 6 Oct.

116 153rd Ldw WD, 2 Oct (op cit, p. 98); also in 68th Ldw WD, ibid., pp. 60 - 61.

The gassing on the 3rd appeared in the 255th Div WD: "Moderate enemy harassing fire with gas and HE on outposts and main line of resistance... on and around Pagny, Preny...Pagny-Sebastopol road and parts of Beaume Haie wood" (German Files Box 232, Folder I, p. 2). In none of these reports or elsewhere was there mention of gas casualties.

"2:00 - 3:00 a.m. Follow up gassing with 400 rounds on the Bois des Rappes positions which had been yperited."[117] There is also no confirmation, German or American, for the order to the 255th Division artillery to fire on the night of 4 - 5 October "Total surprise bombardments using part blue cross on positions...[in the eastern part of the Bois des Rappes and around les Huit Chemins], about 90 rounds."[118]

It has been assumed, from lack of evidence in 90th Division records, that the admissions to the gas hospital between 2 - 9 October were the immediate and delayed casualties following the gas attack of 2 October. The confusion is in no way mitigated by a later DGO letter and map showing light gassing of two areas on 6 October, for which there is no other evidence (Map No. 12). It may be that in the turmoil of adjustment on 2 - 4 October, as forces were shifted to close the gap left by the 78th Division on the left, the keeping of records fell off. The morale of the Division certainly had fallen off, as a consequence of the long period of daily harassment by the enemy. A memo of 8 October made this quite clear when it said that both officers and men "let down badly after the relief."[119]

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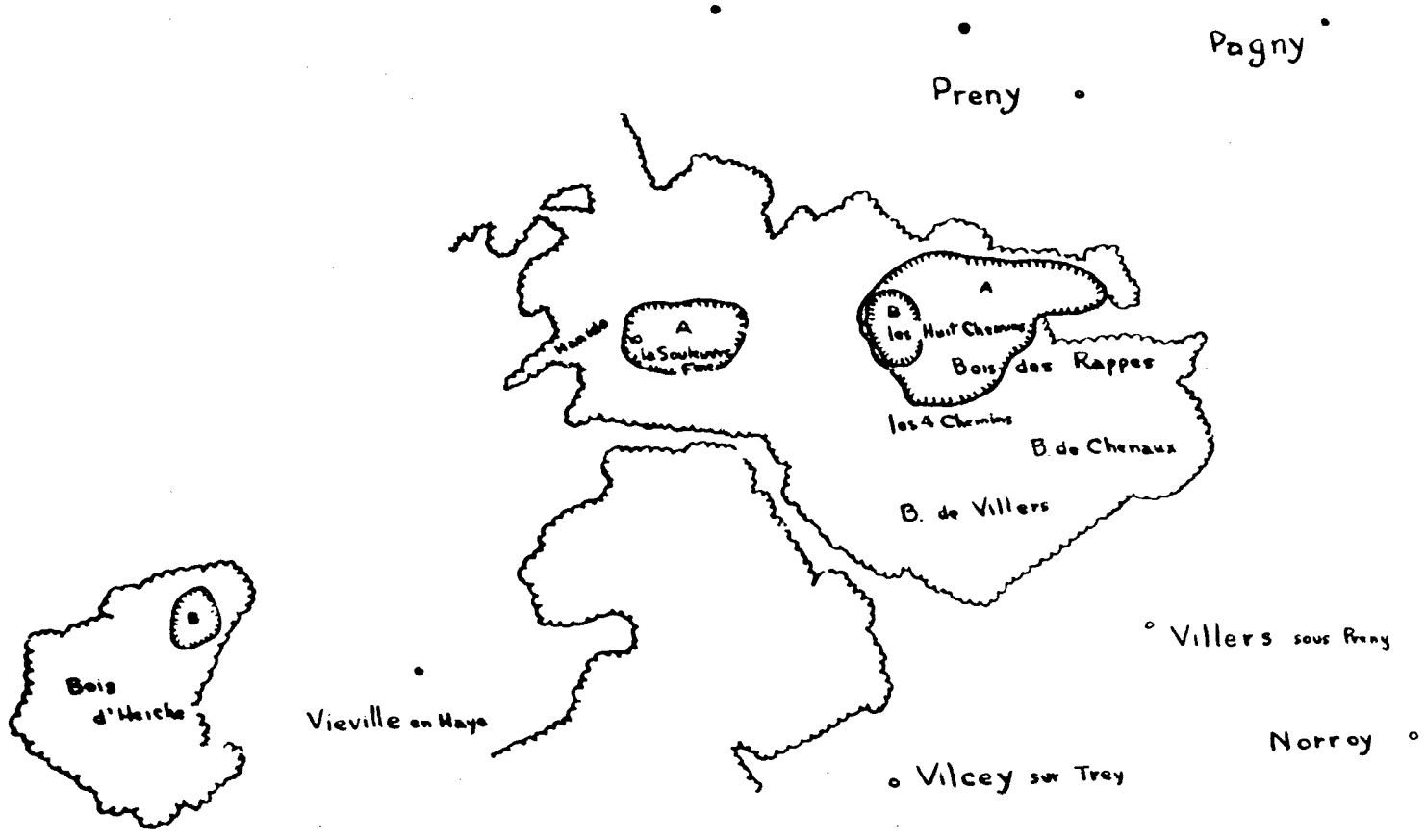
117 Div Order (op. cit., German Files Box 232, Folder I, p. 30); Arty Comd 255th Div WD, 3 Oct (ibid., pp. 127 - 28). Ammo consumption that day was rptd as 1,598 rounds.

118 Order, 4 Oct (op. cit., p. 37).

119 Memo, 90th Div, 8 Oct (90th Div Box 6, 32.15).



90th Division
Areas shelled with Gas
outside of customary gas
shells in harassing fire

Oct 1-6, 1918

A. 2 Oct - 820 YC E of les Huit Chemins
200 YC Soukuvre Fme

B. 6 Oct - 10 YC Bois d'Heiche
10 YC les Huit Chemins

Source: ltr DGO to C CWS,
17 Oct, sub: Gas Atks
90th Div Box 87

MAP NO 12

On 3 October, the division front of the 90th stretched 11 kilometers from south of Pembercourt to Vandieres, as the 78th Division withdrew for the Meuse-Argonne front and the 89th and 90th Divisions extended their flanks to close the gap. That same day, the 5th FA Brigade began the relief of the 153rd FA Brigade that had supported the 90th for more than a month.[120]

When on 7 October the 90th received orders for its relief by the 7th Division, to take place between 8 - 10 October, it directed that all instructions concerning gas alarms and gas positions were to be turned over to the relieving units, and it warned the 7th that "Gas attacks are to be expected at any place in the sector at any time."[121]

ANALYSIS

The Gas Weapon at St. Mihiel

The manuscript History of the CWS, AEF, largely the work of Col. John W. N. Schulz, Chief Gas Officer, First Army, reports with disappointment on the use of the gas weapon at St. Mihiel. To some extent, that was the result of the general lack of experience on the staff level, where all were in a sense learning for the first time by doing. The indecision of Army concerning the use of artillery for the operation (both in the preparation and in the second day's artillery action) had its repercussions in the office of the Chief Gas Officer.

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120 FO 7, 90th Div, 3 Oct; DOR 43, 4 - 5 Oct.

121 FO 8, 90th Div, 7 Oct.

On 16 August, Colonel Ardery, then Chief Gas Officer, said when queried that he had no gas program worked up as yet but suggested that gas and smoke might be valuable adjuncts in the coming offensive.[122] Less than a week later, he requested authority to carry out at once three gas projector attacks along the southern perimeter, to discourage the enemy from concentrating troops too close to the front line.[123] These were the "plans for large-scale gas projector operations" that Colonel Schulz said were cancelled by Army command in order to effect surprise in the coming offensive.

The 1st Gas Regiment plans, proposed on 31 August, for mortar and projector missions with HE, smoke, thermite, and fake flashes in the attack, were for the most part carried out. Omitted from the program was the plan for a lethal gas attack with 400 projectors on the V Corps front.[124] On 7 September, Colonel Schulz wrote that each of the corps had more or less accepted the plans for their attached gas troops, and he had no further plans since the Corps Gas Officers seemed to have things well in hand.

Both Colonel Schulz and Major Hunt, the 90th Division Gas Officer, seem to have felt that the HE, smoke, and thermite missions of the gas

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122 Memo, Col E. D. Ardery for Asst CofS G - 3 1st A (History of the CWS, Vol. 5, App. p. 64, in SOS Box 249).

123 Memo for CofS, sub: Projector Opns (App. p. 67).

124 Ltr, CO 1st Gas Regt to CG 1st A, sub: Proposed opns on First Army Front (App. p. 68). This was not approved, said Schulz, "owing to the uncertainty of the length of time of the Arty preparation and the desire of Army command that no operation of this sort take place before the beginning of the Arty preparation" (p. 17).

troops in the attack might have confirmed the real value of the chemical weapon in the offensive had not the last minute four-hour artillery preparation acted to conceal the effectiveness of that chemical show. But only Colonel Schulz declared that although large quantities of gas and smoke were planned for the artillery, the actual use of these "was disappointing." The failure to use gas shell, he said, was due to (1) lack of appreciation of its tactical advantages during an offensive operation, (2) uncertainty of the length of the artillery preparation, (3) impossibility of using gas extensively prior to the artillery preparation, to preserve secrecy, (4) adverse weather conditions at the time of the attack, and (5) over-sensitiveness to the risks involved to our own troops.[125]

The fourth reason given, adverse weather conditions, was alone sufficient cause for cancellation of the 90th Division's two-hour nonpersistent gas preparation, and almost certainly its effectiveness was largely nullified by the driving rain that morning.

In the attack, smoke candles were effectively used all along the 90th Division front, and the 200 #28 KJ grenades thrown into the smoke screen on the 360th Infantry front appear to have been a successful part of the feint attack at that point (narrative pp. 11 - 12). Concerning the use made of the white phosphorus hand and rifle grenades, there are widely differing reports. The Division Gas Officer said 1,000 #27 hand and rifle grenades were distributed to men in each platoon who were instructed in

125 Col. Schulz, lecture: Gas Plans for St. Mihiel, 13 Jan 19 (1st Army Box 77, 58).

their use, "but they were not used....The infantryman will not carry a load of grenades or any other extra equipment, this being demonstrated by the litter of packs, extra ammunition, grenades, etc., left behind in the field during the advance."[126] The commander of the 2nd Battalion, 358th Infantry, later said: "There were no hand or rifle grenades available for this battalion. The CO this Bn is of the opinion that if grenades had been available losses would have been much smaller."[127] He was probably referring to HE as well as smoke grenades, as was the commander of the 3rd Battalion who said: "Rifle grenades were not made use of for any purpose during the entire battle."[128]

In this connection, the 360th Infantry reported that they were issued phosphorus rifle grenades for the St. Mihiel attack but the grenades were not used because, like the other regiments, none of their men had been trained to use them. Elsewhere in the report it was said that phosphorus rifle grenades were used only by the 359th Infantry, in the raid of 26 September, since that regiment had 60 men experienced in their use.[129]

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126 Ltr, DGO 90th Div to C CWS, 20 Sep, sub: Smoke Screens vs MG Nests.

127 Ltr, CO 2nd Bn 358th Inf to G - 3 90th Div, 20 Sep, sub: Tactical Lessons (90th Div Box 24).

128 Ltr, CO 3rd Bn 358th Inf to CO 358th Inf, 17 Sep, sub: Tactical Lessons.

129 Ltr and atchd Memos, Actg DGO to CGO 7th C, 20 Mar 19, sub: Rpt on Extent to which Phosphorus Smoke Rifle Grenades were used by Inf of 90th Div (90th Div Box 87).

On the second day of the attack, when the enemy was expected to turn, with massed troops and artillery, and counterattack, Colonel Schulz recommended to Army that this would be "an excellent opportunity for the use of gas, especially yperite." In I and IV Corps dumps, he said, there were at least 20,000 rounds of 75-mm. yperite which could be used, even in such fairly high winds as had prevailed the day before. He reported later that the order was actually given to the corps for the use of this shell, but it wasn't used because "the ammunition was not immediately at hand and could not be brought up from the dumps in the rear in time for the particular work intended."[130]

Actually, the gas show and use of gas shell in the St. Mihiel operation were highly creditable, considering the adverse circumstances and above all the disparity between the plans for the operation and the actual requirements. All divisions in IV and I Corps at least appear to have allowed considerable scope to their attached gas troops and to have used large quantities of gas shell in the preparation. Their willingness to use gas, however, undoubtedly received a setback, in view of the absence of any demonstrable results from the use of gas. Firing nonpersistent agents that were rapidly neutralized on contact with the rain and rain-soaked terrain was largely futile. It could not therefore be demonstrated that the use of gas had in any measure contributed to the sudden collapse of the enemy front.

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130 Memo, CGO 1st A for ACofS G - 3, 2:20 p.m., 13 Sep. sub: Breaking up hostile concentrations for counterattack (History, App. p. 72; text, p. 19).

That collapse was as surprising to the high command as to the troops. In the short but lavish artillery preparation and in the attack, only 842,000 out of the 3,310,000 HE shells supplied for the operation were expended.[131] The Medical Department prepared for 30,000 wounded in the three-day operation. Actual casualties on the south front were reported as 3,446 wounded (including 303 German wounded), 532 gas cases, and 147 shell shock cases. On the west front there were 625 wounded, 4 gas cases, and 136 shell shock cases. French casualties were 326 wounded and no gas or shell shock cases.[132]

The Medical Department total of 536 gas cases seems questionable in view of the 90th Division gas casualties in the attack, which alone numbered over 500 (narrative, p. 31). Nevertheless, Colonel Schulz was to say in his lecture that "The use made of toxic gases by the enemy...was very meager, and the number of reported casualties small." It can only be assumed that delay or faulty accounting in the reporting of 90th Division gas casualties caused Colonel Schulz to assume they were incurred during the period of stabilization. As he said further on in his lecture: "After the close of

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131 Maj Gen W. S. McNair, lecture: Army Arty in the St. Mihiel Opn, 23 Dec (1st Army Box 76, 58). Cf Munitions Rpt for Opns A, 2 Oct (1st A Box 102, 44.6).

132 Col A. N. Stark, lecture: Hospitalization in the St. Mihiel Opn, 13 Jan 19 (1st Army Box 77, 58). The total, just over 5,200. Brig Gen Fox Conner, G - 3 GHQ, in his rpt on Reduction of St. Mihiel Salient (1st Army Box 74, 50.1), said First Army casualties were about 11,000, "remarkably light" considering the numbers engaged.

the active operations...the enemy began a method of gas attack on the sector of the 4th Corps, by sprinkling our troops here and there with small numbers of gas shell, far below the concentrations ordinarily used or considered effective. By this means he obtained a considerable number of very light casualties, most cases being returned to their organizations in a few days after being gassed."[133] Again, it would appear that Colonel Schulz minimized the degree and effectiveness of enemy gassing, on the 90th Division front, at any rate.

90th Division Casualties

The DORs of the 90th Division, which report daily casualties and are complete with the exception of one day, show accumulated totals as follows:

	Killed & Wounded	Gassed
23 Aug - 11 Sep	3	12
12 - 15 Sep (the operation)	1,093	201
15 - 25 Sep	329	27
26 Sep (the demonstration)	304	0
27 Sep - 10 Oct	98	309
	1,827	549

These statistics, gathered under battle conditions, are clearly unreliable when compared with the more or less official figures reported after the war. The 90th Division operations history prepared by the American Battle Monuments Commission (1944, pp. 19 - 20), for example, shows St. Mihiel and Meuse-Argonne casualties as follows:

133 Lecture: Gas Plans for St. Mihiel, 13 Jan 19.

St. Mihiel	Killed	Died of Wounds	Wounded
19 Aug - 11 Sep	5	11	143
12 - 16 Sep	301	109	1,597
17 Sep - 10 Oct	252	100	1,528
	558	220	3,268

TOTAL - 4,046

Meuse-Argonne			
17 Oct - 11 Nov	558 (sic)	215	3,068

TOTAL - 3,841

Ayres, in his statistical summary, The War with Germany (p. 117), reports total casualties of the 90th Division in World War I as 1,387 killed and 6,623 wounded. His total of 8,010 may be compared with the total of 7,897 in the Commission study, and the figure, 9,367 (missing men excluded), arrived at by Wythe.

Wythe (p. 155), who appears to have accepted the figures of the Division Adjutant (and the Division Medical Gas Officer), has the following battle casualties for the division:

	Killed		Severely Wounded		Slightly Wounded		Gassed		Missing	
	O	EM	O	EM	O	EM	O	EM	O	EM
St. Mihiel	18	506	31	414	82	2,841	60	1,330	7	196
Meuse-Argonne	19	536	31	843	41	1,830	21	764	0	140
	37	1,042	62	1,257	123	4,671	81	2,094	7	336

TOTAL - 9,710

[134] Includes 17 deaths. Of the total, says Wythe (the error of 100 is his), 854 were returned to duty, 1,204 were evacuated.

This total of gas cases at St. Mihiel, above, appears to have had general acceptance. The division gas hospital said: "The Triage of the 90th Division [operated by the 357th Field Hospital at Griscourt] handled, on the St. Mihiel front, a total of 7,417 cases....The total number of patients received at the gas hospital [the 358th Field Hospital at Rogeville]... was 2,060, of which 1,390 were gassed: 460 mustard and 930 lachrymator and sternutator cases. Of these gassed cases, 844 were returned to duty, 529 evacuated, and 17 died."[135]

These total figures of the Division Medical Gas Officer and the gas hospital agree fairly closely with those reported by the Division Gas Officer, despite differences in daily casualties, as revealed in the chart on page 63. Their discrepancy with the Division Surgeon's figures cannot be accounted for, but it seems that malingering or faulty diagnosis may be ruled out since the DMGO's letter of 15 November expressly states:

> During the activities on both [the St. Mihiel and Meuse-Argonne] fronts only two cases were brought to my attention that were not gassed, a 2nd Lt. who had pulmonary tuberculosis and gave no history of gas, the other a cook who was promptly returned to duty. Not only did we not have gas malingerers in the division but we had many men who fought with their mouth pieces and nose clips adjusted, eyes being exposed (because of fogging of eye pieces) and who later developed trouble with their eyes, reported to battalion aid stations for treatment and voluntarily returned to duty.

This same letter says that in the St. Mihiel sector "no case was evacuated from the division until he had been under observation one week or longer and only when it appeared that it would require weeks for him to recover."

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135 Hist Rpt of FH 358, 315th San Tr (Med Dept Box 3983, Folder 25). See also Wythe, p. 137, and ltr, Maj Charles M. Hendricks, DMGO, 15 Nov.

	Division Surgeon Data				DMGO Gas Data	DGO Gas Data
	Wounded Remain'g	Wounded Admitted	Gassed Remain'g	Gassed Admitted		
Sep. 1	15	7	2	0	-	-
2	15	11	2	0	-	-
3	20	14	2	1	1	1
4	22	5	1	13	12	12
5	15	9	14	2	4	2
6	15	10	5	13	11	10
7	16	1	18	4	3	4
8	-	-	-	-	2	2
9	13	5	18	2	2	2
10	11	6	13	2	2	2
11	5	9	9	5	2	2
12	1	96	8	0	0	0
13	10	543	0	104	99	101
14	161	165	103	35	35	34
15	2	254	104	156	148	141
16	2	170	245	177	174	170
17	2	97	386	126	123	122
18	9	42	410	103	69	69
19	8	16	458	49	44	46
20	6	28	376	31	30	27
21	6	37	383	8	7	22
22	6	34	290	13	13	12
23	0	21	263	20	25	15
24	0	27	205	10	2	2
25	0	73	212	3	3	3
26	2	15	198	4	77	77
27	0	274	179	82	43	42
28	0	19	234	43	124	150
29	0	16	274	50	29	34
30	0	94	418	30	9	9
Oct. 1	0	21	424	9	8	9
2	0	12	388	10	39	38
3	0	3	390	39	180	182
4	0	6	407	172	34	32
5	0	8	467	34	19	18
6	0	7	436	19	9	11
7	0	14	412	10	4	4
8	0	6	396	8	-	-
9	0	2	126	5	-	-
		2,177		1,492*	1,386**	1,407***

* Daily Rpt of Patients in FHs, 90th Div (Med Dept Box 3981, Folder 2).
** Ltr, DMGO to Col Paul S. Halloran, Div Surg, 15 Nov, sub: Final Rpt (Med Dept Box 3982, Folder 8).
*** Revised Monthly Rpt of Gas Casualties, Sep & Oct (90th Div Box 87). The original Monthly Rpt of Gas Casualties, showed a total of 1,324 for Sep, corrected in the revised copy, as here, to 1,113.
Note 1: The DGO recorded gas deaths separately, and listed but 6 where the DMGO (who included them in his figures) reported 17.
Note 2: The DGO reported 4 gas casualties for the period 22 - 31 Aug.

The letter also reports the case of the "3 officers and 130 men who had suffered to such an extent [from gas at St. Mihiel] that [when examined by a board of medical officers in the Meuse-Argonne sector] it was necessary to evacuate them from the division. None of these men had reported to the battalion aid station while in the St. Mihiel sector." Since there is no reason to doubt this incident (it is repeated elsewhere in the records), the gas totals in the chart should all be increased by 133.

Adequate gas data are available for statistical survey of three periods while the 90th Division was in the St. Mihiel area: 1 - 11 September, 12 - 21 September, and 2 - 3 October.

While division headquarters reported a total of 10 men killed and 39 wounded between 22 August and 11 September, medical records (which do not indicate deaths) show a total of 77 wounded and 42 gassed for the September period alone, with the gas officer reporting an additional 4 gas cases in late August. On the basis of a minimum of 5,000 HE shells and 700 blue and green cross gas shells falling in the sector in that period (narrative, pp. 7 - 8), the HE casualties were produced at the rate of 1 for every 57 shells, gas casualties at the rate of 1 for every 15 nonpersistent gas shells. The effectiveness of the gas shell is all the more remarkable in view of the heavy rainfall that month.

In a letter reporting on the gas shelling over the ten-day period, 12 - 21 September, Major Hunt said that "an estimate based on a compilation of data available and personal observation of the percentage of gas used by the Boche in fire places the figure at between 600 and 750 gas

shells per day, on targets scattered over 10 square miles" (narrative p. 36). Accepting the median between his gas shell figures, his total of 887 gas casualties in that period, reported in the same letter, would suggest that 7.8 gas shells were required for each casualty. But medical and revised gas officer data show 789 and 732 gas cases in the ten-day period, with the median 760. On this basis, 8.9 gas shells were required for each casualty. The increased effectiveness of gas shell over the previous period is explained by the considerable use of yellow cross shell, made available to the German batteries soon after they arrived in the Michel Stellung.

In the attack on 2 October, the Germans reported firing 3,000 yellow cross rounds, in contrast to the Division Gas Officer's estimate of 820 rounds (narrative, pp. 49 - 51). The restriction of the results of this gas attack to the 2nd Battalion, 358th Infantry, in gas attack and other divisional records is difficult to justify, and 820 rounds may represent only the gas shells in the 2nd Battalion area. In the absence of gas attack reports from other units of the division, it may be assumed that much of the yellow cross shell fell in areas previously contaminated and therefore more or less permanently prohibited to the troops. There is evidence that such was the case in the 30th Division sector. Assuming that the German figure is the more accurate, the 430 total gas casualties, immediate and delayed, would represent one casualty for every 7 yellow cross rounds. If it is objected that the 430 casualties were reported over the period 2 - 7 October, during which time there may have been a repeat gassing of the area with 400 yellow cross and an unconfirmed mission of 90 blue cross shells (narrative, pp. 52 - 53), the total German estimate

of 3,490 blue and yellow cross still represents little more than one casualty for each 8 gas shells.

One other survey may be of interest. If the incomplete but adjusted data of the Summaries of Intelligence are accepted, showing a minimum of 20,620 HE shells and 6,180 gas shells fired by hostile artillery into the sector between 15 September and 10 October (narrative, pp. 35 - 36), the medical record of 1,296 wounded [136] and 1,444 gas casualties in this same period (gas casualties include the 133 delayed cases) would indicate that 16 HE shells were required for a wound casualty in contrast to 4.2 gas shells to produce a gas casualty.

Parenthetically, it may be observed here that both Major Hunt (later I Corps Gas Officer) and his successor, Lieutenant Coulter, were highly articulate officers and for the most part diligent keepers of records. As the narrative has indicated, however, Major Hunt was not always wholly accurate, and there are important lacunae in his otherwise remarkably complete files.[137]

It may be noted also that on 31 August, a letter to Division gas officers from the Chief of Defense Division, CWS, AEF, directed that thereafter in addition to the immediate telegraphic report of gas attacks and

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136 It is assumed that the omission here of killed and shell shocked battle casualties is compensated for by the fact that this figure of 1,286 includes those wounded by machine gun and rifle fire as well as shell fire.

137 See narrative pp. 7 - 8, 34, 49 - 50.

the written report within 48 hours, these reports were to be accompanied by a map showing "topography of the terrain attacked, special features, distribution of troops, distribution of the various kind of shell used, and wind direction." Outside of Major Hunt's files, such maps are few and far between in surviving DGO records.

The letter of 31 August is an important one because it directed a new form to be prepared, a monthly tabulated report on gas casualties, requested because of the "great discrepancies that exist between the total number of casualties reported in gas attack reports and the number reported by the Medical Department." In particular, gas attack reports did not include "the delayed casualties which develop after gas attack reports are submitted."[138]

Gas Discipline

The 90th Division seems to have prided itself on its gas discipline. As a result of the long training period in the States, its "regulars" may well have made it one of the best gas trained divisions in the AEF. When high gas casualties occurred at St. Mihiel, Major Hunt pointed out that they were principally among the new recruits received by the division in April, just prior to going overseas. These recruits, he said, comprised over 40 percent of the division.[139]

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138 Ltr, OC CWS SOS to DGOs, 31 Aug, subj Rpts on Gas Atks & Casualties (90th Div Box 87).

139 Ltr, DGO to C CWS, 18 Jul, subj Asst Gas Officer required (90th Div Box 87).

To get the new men ready, all units of the division trained and retrained in gas defense and gas mask drill in the brief period before going in at St. Mihiel, in the weeks preceding the attack, and again in the weeks that followed. Yet the division seems to have had as much difficulty maintaining its unit reserve of gas masks as other divisions, through having to replace those "lost" or "mislaid" while the troops were on the march or in action (narrative, p. 44, and below). In relatively quiet periods at the front there was the same carelessness about wearing the gas mask (see below). Under gas bombardment, troops might wear the mouthpiece and nose clip, but would not don the mask properly because of fogging of the eye pieces (narrative, pp. 45, 50, Analysis p. 62),[140] and they consistently removed their masks too soon following yellow cross shoots (narrative pp. 27 - 28, 48 - 49). Finally, in actual combat there was the same tendency of the men to "throw away everything except...rifles and grenades."[141]

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140 In the course outline, Training in Gas Defense for Divisional Anti-Gas Schools, Nov. 1917 (90th Div Box 13, 52.3), p. 4a, was a paragraph about the then new German yellow cross shell:

The shells were used on July 12th and 15th at Ypres and again on July 21st and 22nd at Nieuport. Owing to the inconsiderable smell there was delay in use of the Small Box Respirator. The Artillery also who for the purpose of clear vision have acquired the habit of using the noseclip and mouthpiece of the Small Box Respirator without adjusting the whole facepiece, failed to protect their eyes. The casualties were, therefore, considerable. In a later bombardment at Armentières July 28th and 29th the efficiency of the Small Box Respirator was fully proved and the casualties were inconsiderable.

Although an anti-dim paste was quickly devised and issued to troops, all too often it was not used or improperly used. See Memo, 90th Div, 4 Oct, subj Gas Tng & Gas Disc (90th Div Box 6, 32.15).

141 90th Div Notes on Recent Opns, 5 Oct, p. 5 (90th Div Box 6, 32.15). Referring to this par in a set of comments appended to these Notes by "GAW", a member of the GS, 79th Div, is the phrase, "Same trouble."

Cf. Analysis, pp. 56 - 57, re troop attitude toward grenades.

"Everything" undoubtedly included their gas masks.

In a letter in which Major Hunt reported 887 gas casualties between 12 - 21 September, 145 of them mustard gas burns (the total was later to be reduced), he nevertheless insisted that the gas discipline "is very good in general." He and the medical officers agreed that the large numbers of mild casualties were due to the presence of gas in very mild concentrations:

> Only about half the men say they even smelled gas. Some men smelled TNT of the HE shells and being familiar with that and detecting no foreign smell did not put on their masks until they had breathed it for some minutes. The woods are full of various odors, offensive and otherwise, dead animals, crushed foliage, upturned earth and rotten wood, HE, and gas. The undersigned has walked for miles thru these woods and passed on thru without wearing the mask, and I realize personally that the men who are in the woods day and night have the same tendency...otherwise one would be wearing the mask constantly.[142]

As the weeks of daily gas fire passed, the troops, old hands as well as replacements, tended to become careless or resigned to the commonplace. On September 28, the Regimental Gas Officer of the 358th Infantry reported that the discipline of the 315th Engineers, 301st Engineers, and the 10th Engineers had become seriously lax: "the first two units have men continuously without masks or in the slung position in the alert zone, while some men from the 10th Engineers want to carry the M2 mask."[143] And on 3

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142 Ltr, DGO to C CWS, 23 Sep, sub: Gas Attacks (90th Div Box 87).

143 Ltr, Scurlock RGO 358th Inf to DGO, 28 Sep, sub: Weekly Rpt (90th Div Box 87). The presence of the 301st Eng (76th Div) and 10th Eng (unidentified) is not referred to in any other record of the 90th Div.

The Engineers had been careless before. "At 2:00 a.m. on Sept 4, the company encountered its first gas alarm....As two or three men had mislaid their masks by the roadside it was probably just as well there was no gas with the alarm." Hist of Co C, 315th Eng (90th Div Box 28, 11.4).

October, just the day after the 358th Infantry had been badly gassed, a company commander reported that two men "were found back of first battalion area without gas masks in slung position....As disciplinary action I have given them ten extra hours digging in the trenches."[144]

A G - 3 Memo on October 4 agreed with Major Hunt on the undisciplined element in the division: "Over 1,100 gas casualties have occurred in this division during the last month. Examination of the casualties show that at least 60% were inexcusable being due to flagrant breaches of gas discipline....75% of the gas casualties were men who joined the division in April and had not had...Camp Travis training." Henceforth, the memo said: "All men evacuated as gas casualties will be tried by summary court martial for neglect of duty when the nature of the casualty indicates that they have committed a breach of gas discipline. Simple mustard gas eye cases will be considered prima facie to result from neglect of duty except in the case of men on special duty in gassed areas, such as runners, patrols, or reliefs." Meanwhile, all troops in the back area were to have one hour a day of gas drill, with gas drill also made a part of all other drills. There would be special training against surprise, since it had been found that men startled by the gas alarm did not respond quickly enough in putting on their masks.[145]

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144 Memo, CO Co A, 358th Inf for RGO, 3 Oct, sub: Action taken for violation of Gas Rules (90th Div Box 87).

145 Memo, G - 3, 4 Oct, sub: Gas Tng and Gas Disc (90th Div Box 87).