

# The Fog of War

## Large-Scale Smoke Screening Operations of First Canadian Army in Northwest Europe 1944-1945

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Smoke screens have been employed in sea and land warfare for many centuries for a variety of purposes. They have been used to conceal troop movements, to deceive the enemy as to combat strengths, points of attack, and preparations for offensive operations. During the Second World War all armies made use of smoke screens in their operations to a greater or lesser extent. Canada was no exception and was considered to be extremely innovative in the use of smoke equipment in ways for which it was not designed. The First Canadian Army first employed large-scale non-artillery-projected smoke screens during the campaign in Northwest Europe. For the first time, at least in the history of Canadian operations, units of trained specialists worked to lay down smoke screens in the field.

### Background

Military smoke screens are basically clouds of particles which are effective in absorbing, reflecting and/or refracting light rays. In Northwest Europe the Canadians used two different materials to produce major smoke screens.

The first was zinc chloride. Zinc or zinc oxide reacts with chlorinated hydrocarbons, such as carbon tetrachloride or hexachlorethane, to produce a zinc chloride vapour which condenses in the air to create an effective white smoke. There were, and still are, a number of different formulations, all of which were known as "HC" smokes (for HydroCarbon). In addition to being employed in a variety of artillery shells, mortar bombs, and hand grenades, HC was employed



in smoke generators, commonly known as "smoke pots." The best known examples of these was the British No.24 Smoke Generator, weighing about 40 pounds and burning (emitting smoke) for 12 to 15 minutes, and the U.S. Army M4 floating smoke pot, similar to the No.24 in weight and smoke production characteristics, but fitted with a flotation chamber.

The second was oil smoke. Three different kinds of oil smoke generators have been used in modern warfare. An effective smoke can be produced by injecting oil into the hot exhaust of a vehicle, the oil condensing in the air to form a smoke cloud. Some naval vessels could produce this type of screen, which became known as a "Destroyer Screen." The British developed an oil smoke generator which partially burned and partially vapourized oil. This generator, called the Haslar after the experimental station where it was developed, weighed about one ton and was mounted on either a trailer or a truck. Its role was to screen ports and factories from Luftwaffe observation and attack. It produced a fairly effective smoke cloud in the anti-aircraft role for which it was designed, although it covered nearby buildings and gardens with a sooty layer of oil. It was neither soldier-proof nor rugged enough for field use. The United States Chemical Corps developed and produced by contract to Standard Oil a generator which produced superheated oil, combined it with steam and sprayed it into the air. This generator, known as the "Esso," was mounted on a four-wheel low-bed trailer as a self-contained unit, holding fog oil, fuel oil and water

for about two hours' operation. The output was variable. The Esso was standard in the U.S. Army Chemical Corps Smoke Companies and was issued to British Pioneer Corps Smoke Companies serving outside the United Kingdom. The Esso was supplemented in the last few months of the war by the "Beslar," a miniaturized version which could be carried by two men.

The Canadian army's first real experience with large-scale tactical smoke screens was the assault on Dieppe on 19 August 1942. In this operation, known as "Jubilee," the RAF close support included "smoke-laying aircraft to neutralize enemy defences both as pre-arranged and as requested by the Military Force Commander." Three squadrons were allocated to this task and in the actual operation supplied support to the Royal Regiment of Canada landing at Puy and the Royal Hamilton Light Infantry and Essex Scottish landings on the beach directly in front of the town of Dieppe.<sup>1</sup> Although the air support was of some value, the inflexibility of timing of the support substantially reduced its effectiveness. Some aircraft did attempt to screen the evacuation of casualties from the beach, but with only limited success. The experience reduced the confidence of the army in aerial smoke support, a feeling which persisted throughout the campaign in Northwest Europe.

To put the large-scale tactical smoke screens used within First Canadian Army in Northwest Europe into perspective, it is necessary to look at the position of the Canadian Army in Britain

prior to the despatch of 1st Canadian Infantry Division to the Mediterranean in 1943. In the planning for the invasion of Europe Canada was not seen as having any responsibility for the provision of "Theatre" troops, or units directly under Theatre Headquarters command. Smoke troops were included in the order of battle of both the British and US Army Groups with the assigned task of screening beachheads and the build-up of men and stores from German air attack. Britain, the United States, and Canada all had staff and technical staff officers trained in chemical warfare defence at the various formation headquarters. The US Army had a "Chemical Officer" in the rank of colonel at each division and in a correspondingly higher rank at the corps and army level. These officers' responsibilities included all aspects of chemical warfare such as flame, protective measures against chemical attack, analysis of captured enemy ammunition, as well as planning and execution of major smoke screens. The British had a "Chemical Warfare Technical Officer" at each corps headquarters, usually in the rank of captain. If staff trained, he was called a "Technical Staff Officer." The British had no such officers at the divisional level, and only a small staff at Second British Army Headquarters.

At First Canadian Army Headquarters, Lieutenant-Colonel W.R. (Reg) Sawyer was the GSO1 (CW), ie. the grade one staff officer, responsible for chemical warfare and smoke. Sawyer had a staff of eleven all ranks, including chemists, flame equipment and tactics instructors, as well as officers trained in the tactics, chemistry and the micro meteorology of smoke screening. In addition, there was a mobile Chemical Warfare Laboratory based at Army Headquarters. With the exception of the 4th Canadian Armoured Division, the Canadian and British divisions did not have Technical Officers, and this exception was as a result of the insistence of Major-General G. Kitching, the divisional commander.

I held the position of Technical Staff Officer (Chemical Warfare) at Headquarters, II Canadian Corps, and, commencing in March 1945 was assisted by a Technical Officer. I was fortunate in that I had completed the Canadian War Staff



*Captain Jim Bond and Major Stewart Bastow, MC during operations in the Rhineland, February 1945.*

Course in Kingston in 1943 and that, combined with a B.A. and an M.A. in Chemistry, apparently qualified me for the slightly better paid job of "Technical Staff Officer," rather than a straight "Technical Officer." I don't think that my duties or responsibilities were ever spelled out in black and white, but it was generally understood that anything within the Corps that had to do with chemical defence training and equipment, flamethrower training, equipment and tactics, and smoke screening, other than that produced by the artillery or infantry, was, at least initially, to be referred to me. This was pretty heady stuff for a captain and it was quite humorous, and a bit embarrassing, when the American 82nd and 101st Airborne Divisions came under command of our Corps, and the two Divisional Chemical Officers, both colonels, reported to the "Canadian Corps Chemical Officer." Several years after the war, when I was posted as liaison officer to the U.S. Army Chemical Corps, I worked with both these officers and we had many laughs about the differences in rank.

Early in 1943 Lieutenant-Colonel Sawyer, with the support of General A.G.L. McNaughton, initiated trials to determine the practicality of supporting river crossings and other operations by producing smoke screens by methods not requiring the use of artillery or other projectiles. It had been recognized that artillery and mortars could accomplish the task, but only at an extremely high logistical cost, and the diversion of these weapons from their role of firing high explosive munitions. The actual "hands-on" experience in planning and operating a large and prolonged smoke screen was difficult to achieve in southern England, and in fact only one full-scale combined trial and demonstration was held. This was a simulated river crossing near Edenbridge in Kent. This demonstration was little short of a disaster, but the lessons learned about smoke and fickle weather directions and conditions proved invaluable in our actual operations.

A review of the Canadian army participation in the Italian campaign<sup>2</sup> shows that tactical smoke screening was largely limited to artillery support, at times on a massive scale, but no record of prolonged screening in the Canadian sector has been found. Artillery smoke screens were mentioned by Nicholson in the Ortona, Liri Valley, the Rimini Line and Romagna areas. Some

units, including the Royal Canadian Dragoons were trained in the use of the No.24 British Smoke Generators, but no successful operational use was recorded. In fact the only reference to generator smoke in the Dragoons' history is to their lack of success.<sup>3</sup> In Italy the smoke resources were more limited than in Northwest Europe and of these some were retained in the port areas as protection against enemy air attack.

The Canadian contribution to the D-Day landing in Normandy was 3rd Infantry Division supported by 2nd Armoured Brigade. In addition, under command of 6th Airborne Division, 1st Canadian Parachute Battalion landed on D-Day on the extreme left flank of the Allied operation. By 11 July II Canadian Corps was operational and assumed command of these formations, together with a normal complement of corps troops. Second Canadian Infantry Division and 4th Canadian Armoured Division came under corps command as they joined the force later in the month. Headquarters First Canadian Army became operational on 23 July.

During this period, and extending until the breakout from Normandy, the Canadian Army made considerable use of artillery and other projected smoke munitions. With the prevailing winds being generally southerly and the enemy positions close to the forward line of our troops (the Allied advance was generally in a southerly direction) there was little or no opportunity for the tactical employment of non-projected smoke stores.

Smoke screens were employed to conceal against aerial attack and artillery shelling in the Normandy beachhead, principally on the eastern flank.<sup>4</sup> This screening was carried out by British Royal Pioneer companies, specifically by Numbers 806 and 112 companies. These two companies were later involved in almost all the tactical screens in the Canadian sector and they brought with them many innovative ideas on how to produce effective screens in adverse conditions.

### **Tactics and Techniques**

**T**he basic tenet to be followed in the employment of smoke screens is to remember that smoke is a two-edged sword and that in "blinding the enemy" one has to ensure that the smoke does not hamper one's own

operations. When using projected smoke munitions one can actually place the smoke on an enemy position or erect a screen between one's own position and the enemy's points of observation. Using smoke generators complicates matters because the location of the smoke source is restricted to a location controlled by friendly forces, or which is not accessible to the enemy. This constraint makes meteorological conditions very important, as it is impossible to make a smoke screen travel against the wind. Wind speed is also a factor, as strong winds not only tear a screen apart but also reduce the height of the smoke cloud. There are other significant factors such as humidity and air turbulence (caused by strong sunlight or rough terrain), which have to be taken into consideration when planning a screen and deploying one's smoke and manpower resources.

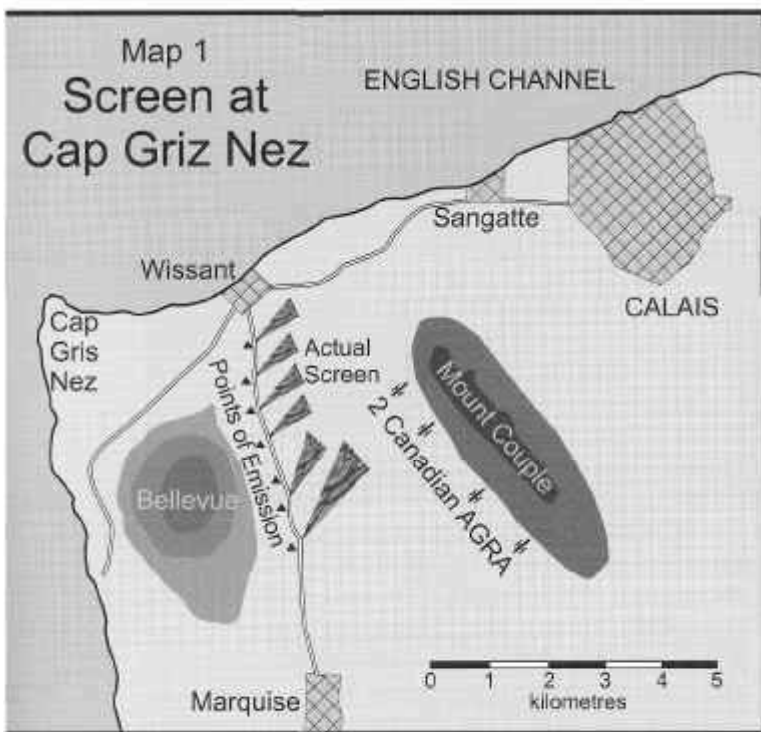
It is possible to calculate the size ( the length, width and height) of a screen from a single source, such as a No. 24 generator, under known "met" conditions. From that data an ideal source line, consisting of smoke points of one generator each can be plotted with a calculated distance between the points. At this point in the plan the line and the point spacing must be adjusted to sites that are accessible and, if possible, not in full view of the enemy. In some cases it may be necessary to double the number of generators at a point and increase the spacing between points. If using the large Esso generators, it might be necessary to establish a small preliminary screen with No. 24s to cover their move into position. Once a screen was established and appeared stable it was normal to analyze it in order to ensure that even under moderately changed met conditions, or the loss of one or more smoke points, the success of the operation would not be jeopardized. One also tried to be as economical as possible in the expenditure of stores.

In actual practice a fair amount of improvisation was required, such as the massing of Essos at a single point at Wyler in the Rhine operation to screen miles of flooded and semi-flooded areas. The operations described below give other examples of the techniques employed to provide smoke support, as well as examples of failure to do so.

### **Operation "Undergo" Cap Gris Nez and Calais**

The first use of smoke in Northwest Europe to screen Canadian Army operations for a prolonged period of several days, was in support of the 3rd Canadian Division assault on Calais in September 1944. It had been hoped that the German force manning the batteries of large calibre artillery located in emplacements in the Cap Gris Nez area would have surrendered before the assault on Calais was mounted, but an unsuccessful night attack on 16 September, and pressure from Headquarters 21 Army Group to open all the Channel ports, forced a decision to contain the Cap Gris Nez position and capture Calais. To support the division and to minimize casualties, the divisional artillery was augmented to 19 regiments of field and medium artillery. The optimum battery positions for this massed artillery were in the Marquise-Mount Couple area and were visible to the German guns at Cap Gris Nez, at least one of which was capable of a 360-degree traverse.<sup>5</sup>

On 19 September, as Technical Staff Officer, II Canadian Corps, I was instructed to determine if a smoke screen to shield the artillery from the German battery was feasible. I made a reconnaissance and studied prevailing wind patterns. I then reported that there was a very high probability that an effective smoke screen could be laid and then more or less forgot about the idea. At 1800 hours on 22 September I was ordered to have a screen operational not later than 0715 hours the next day. At this point there were comparatively few smoke pots (British No.24 generators), and no other smoke generators available in the corps forward maintenance area. Within two hours a detachment of 23 gunners from the divisional 3rd Light Anti-Aircraft Regiment reported for duty at Wissant where I had established a command post. There were no NCOs, no cooks, nor provision for any extended detached duty. By 0400 hours smoke pots were arriving from beachhead stocks in Normandy, and a smoke source line some 3,000 yards long, with 51 smoke points at 50 yard spacing, was laid out. The smoke pots were lit promptly at 0700 hours. I then moved as close to the German positions as I reasonably could to gauge how effective the



smoke screen was and whether or not the emission line should be moved or modified. During the day the number of points was reduced by trial and error to 18 without loss of effectiveness. The whole "group" was organized, shifts detailed, feeding arranged, and technical support obtained in the persons of a meteorological officer from Army Headquarters, and one of the camouflage officers from Corps Headquarters. The first day also saw us move from our original base in the town of Wissant because German sniping by one of the large calibre guns had become decidedly uncomfortable.

It had been originally planned to maintain the screen for about a day and a half, but as the assault on Calais slowed down, orders came to maintain the screen as long as our artillery was still in location and Cap Gris Nez had not fallen. The screen was maintained until noon on 28 September, or for the daylight hours of over five days. During this period the supply of smoke pots was a constant worry. At one point some German NbKL42 generators, similar to, but inferior to, the British No.24s, were used. I had identified these in a German ammunition dump at Elbeuf, on the Seine River, when doing a routine check of captured ammunition.

*Canadians astride one of the captured German guns at Cap Gris Nez*

This first smoke operation, for which we were not prepared, did teach us a number of lessons directly related to the use of smoke stores, wind variability, and ways of economizing both in manpower and materials. It also made us realize that there was a real need for a meteorological officer in the planning and maintenance of this type of smoke screen. Probably more important was the recognition by divisional and corps commanders (and their staffs) of the utility and potential of prolonged smoke screens. This recognition, in turn, led to the transfer of some British Royal Pioneer Smoke companies from Theatre to Army control, and the movement forward to corps dumps of substantial stocks of smoke stores. In spite of our inexperience the screen was considered to have been successful, and I was pleasantly surprised to have been mentioned-in-despatches for my part in the operation.

### Operation "Switchback" Part I - The Leopold Canal

Within days a request from HQ 3rd Canadian Infantry Division was received at II Corps HQ for a smoke screen to support an assault crossing of the Leopold Canal by 7th Canadian Infantry Brigade.<sup>6</sup> This assault, made on 6 October, was the first major offensive action to clear the land south of the Scheldt Estuary, which became known as the "Breskens Pocket." The initial assault consisted of two battalion crossings, some two thousand yards apart. Brigadier J.G. Spragge, commanding the brigade,



wanted a smoke screen extending some four miles to both the east and west of the planned crossing points. He also wanted a screen in the immediate area of the crossings to be available and under his direct command. A reconnaissance of the area indicated that, barring unfavourable winds, the brigadiers's needs could be met by the use of a pioneer smoke company, equipped with 48 Esso oil smoke generators, and a platoon with smoke pots and smoke floats. The Canadian Army Meteorological Group forecast southerly winds for the period of the assault and for two or more days later. Brigadier Spragge agreed that there should be no smoke if the winds were northerly. No.806 Royal Pioneer Smoke Company was put under command of First Canadian Army in support of 3rd Canadian Infantry Division, and placed under my operational control (not command). It arrived late in the afternoon of 5 October. The smoke company commander and I planned the company's deployment after making a detailed reconnaissance. The deployment and forward movement of fog oil reserve stocks was completed by midnight 5/6 October. A weather forecast obtained about 0300 hours called for a change in wind direction to northerly, a shift which was almost immediately noticeable locally and which made the effective use of smoke impossible. The assault was mounted and after much bitter fighting the two battalion bridgeheads were linked early on 9 October. The smoke company remained at the alert, but as the wind continued to be from the north no smoke was made.

## Part II - The Scheldt Estuary

A second element of 3rd Division's operation to clear the Breskens Pocket was an amphibious assault by 9th Infantry Brigade from the area of Terneuzen, westward along the south shore of the Scheldt, west across the Braakman Inlet, and landing in the rear of the main German defences.<sup>7</sup> Brigadier J.M. Rockingham, commanding the brigade, wanted smoke to screen the assault from observed fire coming from enemy positions south of the Scheldt, and from the coastal defence guns in the area of Flushing. It was recognized that the screen would have to be continued to conceal the movement of reinforcements and supplies from the same enemy fire. Brigadier Rockingham stipulated that the smoke must not interfere with the tracked landing vehicles (LVTs) known as Buffalos, crossing from Terneuzen to the landing beaches. The brigade staff confidently stated that it was unlikely that the screen would be required for more than 12 hours.

I was not involved in the initial planning of the smoke support for the operation, because I was occupied with the 7th Brigade operation at the Leopold canal. Consequently, Major Temp Hugill of the G(CW) staff at Army Headquarters, and Captain Maurice Comfort, the Meteorological Officer (CW) of the Army Meteorological Group, planned and managed the screen in its initial phases. They quickly realized that, to be effective, the screen would have to be located on the Scheldt Estuary itself. Planning proceeded on this

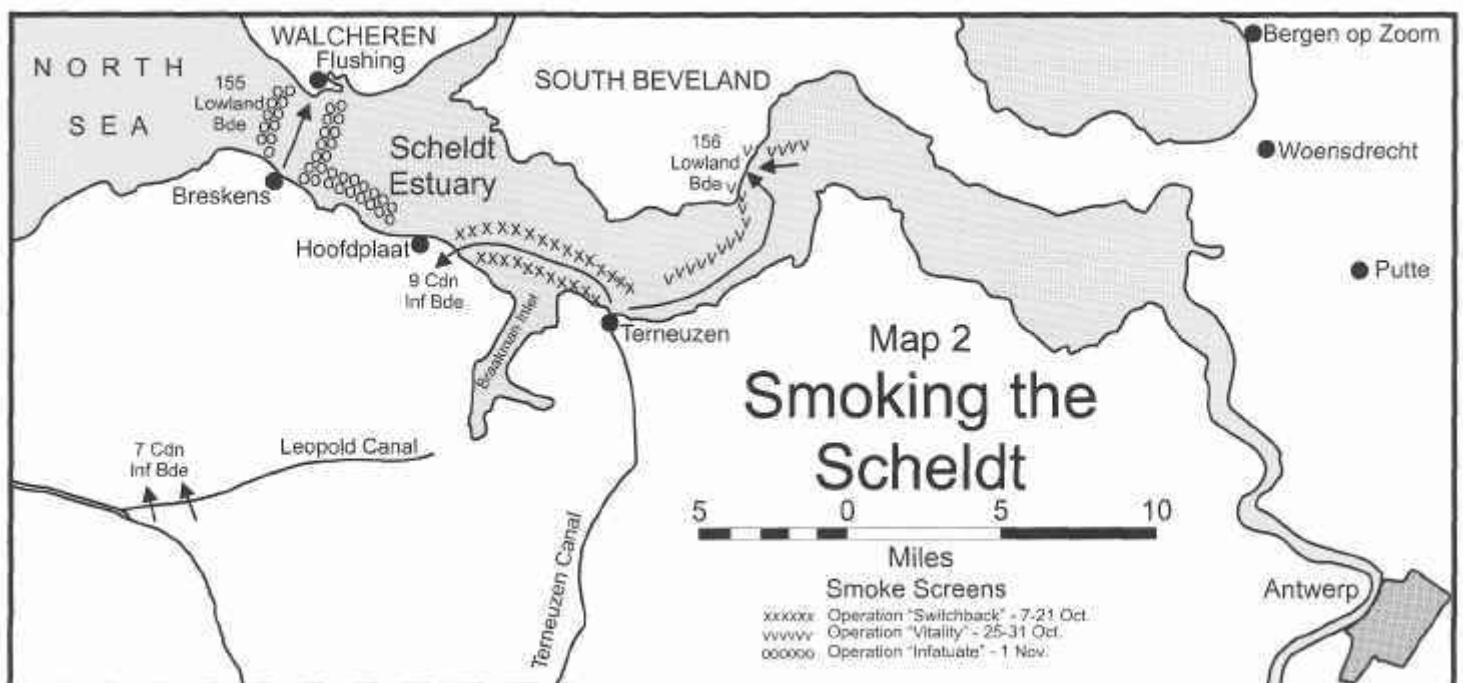




Photo by Donald I. Grant NAC, PA 138430

*With a smoke screen shielding their progress, soldiers from the North Shore (New Brunswick) Regiment are ferried from Terneuzen to Hoofdplaat aboard Buffalo amphibious vehicles, 11 October 1944.*

basis, employing storm boats and DUKWs (amphibious trucks) to drop off a smoke float every 400 yards along a dog-leg line running northwest from Terneuzen for some 8,000 yards. These had to be renewed every 15 minutes, this being the average smoke emission life of the floats. An *ad hoc* smoke organization was formed and equipped, consisting of three DUKWs with drivers, four storm boats with crews, one NCO and nine men as a working party, three wireless operators with a wireless truck, and 800 smoke floats. The brigade assault, which had been planned for midnight 7/8 October, was postponed 24 hours. Due to the unfavourable northeast wind, smoke was not made, although the group stood to until 0200 hours. At 0400 hours the plan for screening against fire from the south shore of the Scheldt was modified to use three Esso oil smoke generators, which had been released from the Leopold Canal operation, sited on the east shore of the mouth of the Braakman Inlet.

At 0700 hours a call for smoke on both flanks of the LVT route was received from brigade HQ and was immediately acted on. As the screen became effective the shelling of the beaches, the LVT exits and the Braakman stopped. The enemy on South Beveland (north of the the Scheldt) then turned his attention to the smoke-laying craft, and to the harbour at Terneuzen where our smoke craft were based. A small secondary screen in front of the harbour corrected the problem, but only after casualties had occurred.

That evening (9 October) Brigadier Rockingham requested that the screen be continued during daylight hours for as long as

his brigade had to be supplied by amphibians. It was also learned that the 8th Canadian Infantry Brigade was starting to phase its battalions in, using the same route. Thus two brigades would have to be maintained until a land route was opened around the south end of the Braakman. It was estimated that the screen would be required for at least three more days.

The extension of the duration of the screening meant that manpower and material resources had to be substantially increased. Captain Norm Mould, the 4th Canadian Armoured Division CW Technical Officer was "requisitioned," and I was able to leave the Leopold Canal operation. He and I assumed responsibility for the details of screening operations, while Major Hugill remained in overall command of the group. Major Stew Bastow, DSO, a free-thinking Australian and the officer commanding the 806 Pioneer Smoke Company, was an important addition to our planning and operations group.

We requisitioned and received one platoon of 806 Smoke Company (12 Esso generators), 3 DUKWs with operators, 4 storm boats with crews, fitters, and extra motors, 8,000 smoke floats, 4,000 No.24 generators, and 400 barrels of fog oil. By this time our original stock of smoke stores was very low, good for less than six hours of operation. During the next week the wind blew from all points of the compass, necessitating constant adjustment of the smoke emission lines. This entailed constant revision of estimates of stores requirements, and of devising innovative ways of using combinations of devices to produce effective screens consuming a minimum of stores. When a shortage of smoke floats developed, our

sappers and pioneers built a number of rafts, using oil drums, scavenged lumber, and wire mesh. These were anchored in the Scheldt, loaded with No.24 generators, and a Pioneer to light the generators. After an incident in which a large calibre near-miss capsized a raft with a Pioneer and me on it, a method of chain lighting the No.24s and eliminating the man on the raft was quickly devised. The Esso generator was found to be extremely versatile. It fitted nicely in the back of a Mark IV LVT Buffalo, which could carry additional fog oil in jerricans. Also it was found only a few days later, that the Esso could be mounted in an Assault Landing Craft (LCA), the only modification necessary being the cutting out of a part of the LCA deck. The DUKWs were very useful for carrying and dropping off smoke floats. Also, with No.24s burning on a metal plate welded to the stern, they could simulate a naval "destroyer smoke screen." In contrast, the storm boats were unsatisfactory, the main problem being their outboard motors, which proved unreliable if run for prolonged periods.

On 16 October there was a link-up of 7th and 9th Brigades, thus providing a land route for supply, and the smoke screen was no longer needed for its original purpose. The II Corps Headquarters staff agreed with our recommendation that, in view of future operations against South Beveland, a screen should be kept at Terneuzen, with a more westerly screen maintained for deception purposes, and to draw fire from the enemy coastal guns so that they could be taken out by aerial attack. This last objective was not attained, although the enemy wasted over 100 medium and large calibre shells.

### **Operation "Vitality" South Beveland**

The participation of the "Smoke Group" in the taking of South Beveland and Walcheren was comparatively minor. It was not involved in the advance of 2nd Canadian Infantry Division as it fought against a determined enemy. To turn the German right or southern flank, an amphibious assault across the Scheldt was made by the 156th (Lowland) Brigade of the British 52nd Lowland Division. This division, which was under the command of II Canadian Corps, had been specially trained in mountain warfare, but was fighting for the first time on terrain largely below sea level. The assault, supported by DD

tanks (Duplex Drive amphibious Shermans) of the South Staffordshire Regiment, took place in the early hours of 26 October. There were two separate landings, both to the northeast of Terneuzen. Flank screens were provided, partly by Essos mounted in LCAs, and partly by No.24s on the flank of the landing beach.<sup>8</sup> The screens were modified as progress was made by the 156th Brigade, with the gradual elimination of the eastern screen. The westernmost screen was maintained until 31 October when the guns of Walcheren were no longer considered a threat. Of particular interest to me was the sight of an officer of 806 Pioneer Company with a detachment of his men coming ashore on the extreme left flank of the assault, casually picking up a couple of No.24 generators each, trudging up the beach, lighting the 24s, and then nonchalantly lighting up cigarettes. All this was against a background of the infantry doing a classical fire and movement advance up the beach. (This incident is recorded in *A War History of the Royal Pioneer Corps 1939-1945*, which states that the beach was under heavy fire).<sup>9</sup>

### **Operation "Infatuate" The Assault on Flushing**

The final chapter of the "Scheldt Smoke Screen Story" was the support given the 155th (Lowland) Brigade and No.4 Commando of the 4th Special Service Brigade assault on Flushing from the port of Breskens on 1 November. This was one half of the assault on the island of Walcheren, the other being a seaborne attack by the 4th British Special Service Brigade on the coastal area around Westkapelle. Air smoke had been planned for the Westkapelle operation, but was aborted on account of bad weather. The smoke plan for the Flushing operation was quite straightforward, calling for screens flanking a corridor from Breskens to Flushing, with the stipulation that there should be absolutely no smoke in Breskens harbour or in the corridor. The brigade commander finally accepted the fact that if the wind was westerly, some smoke was bound to blow into the corridor, but he insisted that he have a direct radio link to that screen sector so he could order a shut down at short notice.

The assault on Flushing started on schedule on 1 November at 0530 hours. There was no enemy shelling of the Breskens harbour or the



*"Esso" smoke generators in operation along a dyke west of Terneuzen, 13 October 1944.*

*Photo by D.I. Grant, NAC PA 136818*

corridor until about 1020 hours, whereupon the brigade commander together with the Naval-Officer-in-Charge asked for smoke even if, with the current northerly wind, it blinded the Breskens harbour. The hostile fire switched targets from the harbour and the corridor, concentrating on the smoke-laying LCA. The screen was maintained until about 1600 hours when enemy action holed the LCA smoke layer. The craft made it close to the beach near Breskens and the whole crew were able to swim ashore. (The water in the Scheldt in November is cold!) By this time the batteries that had been firing on Breskens had been overrun or silenced and the smoke operation was closed. Thus ended a month of long, nightly drives to obtain meteorological data, of spending most of the daylight hours afloat, and of improvising to make stores last and inadequate equipment work. On the other side of the ledger, we were confident that the smoke operation reduced Canadian and Allied casualties and substantially assisted the

operations. There was also the privilege of working with dedicated companions and Pioneer troops, who, General Dempsey said, "set a splendid example in keeping with the highest tradition of their Corps."<sup>10</sup> A further bonus was the daily rum issue for being "waterborne."

In the operations on the Scheldt in October 1944, over 500 tons of smoke materials were consumed, and smoke screens were laid on 29 days of the month. A point of which I am most proud is that we had no fatal casualties in our smoke troops over this period.

### **Winter Operations**

**A**fter the Battle of the Scheldt the Canadian divisions were shifted northeastwards to the Nijmegen salient, and offensive operations were limited to "active patrolling," which nonetheless at times involved very bitter fighting and heavy casualties. Second Canadian Corps took over the Nijmegen salient from 30 British Corps in early

November 1944 and, with some shifting of divisions, was responsible for the line of the Maas River some ten miles southeastwards from Nijmegen and westwards beyond 's-Hertogenbosch. To the west of this I British Corps, under command of First Canadian Army, had an area of responsibility westwards to the coast. The winter period of strategic planning for operations to clear the area westwards from the Rhine River to the Maas River gave the chemical warfare staffs an opportunity to analyze past smoke operations, and to decide what organization would be necessary to implement any large-scale screening that might be ordered in the expectation of a major Allied offensive. The Ardennes offensive launched by Germany on 16 December 1944 delayed the Allies' offensive. Operation "Veritable," designed to clear the west bank of the Rhine, was launched 8 February 1945.

In this winter period there was real concern that the enemy might attempt to destroy one of the bridges over the Waal River at Nijmegen by aerial attack or by observed artillery fire.<sup>11</sup> In September the Germans made an attempt, using naval mines positioned by divers. This was partially successful, but later attempts were less so. Similarly, an aerial attack by 73 aircraft was a failure. To counter the aerial threat the Allies planned to conceal the bridges by smoke. Trial runs were made, using different deployments of the Essos, while I observed the screens from an aircraft. We soon found that, in winter conditions in the Netherlands, the smoke hung close to the ground, leaving the bridge superstructure highly visible as an isolated target.

On the personal side, I applied for and attended a course at the Royal Engineer "Mine and Booby-Trap" school at Knoeke-sur-Mer in Belgium. Within weeks this proved to be worth the effort.

### **Operation "Elephant" Kapelsche Veer**

**T**he most disappointing, and tragic smoke support task with which I was involved took place on 26 January in the 30 British Corps area to the western or left flank of our corps. A few miles northwest of 's-Hertogenbosch the Maas River divides forming a small island several miles long and about a mile wide. The island is very flat and typical polder terrain. On the north side of the island at about mid-point in its length is a

small ferry harbour called Kapelsche Veer. The enemy had occupied this area since September 1944 in spite of attempts to dislodge him by the 1st Polish Armoured Division and later by 47 Royal Marine Commando. This led I British Corps to order the 4th Canadian Armoured Division, which was under its command, to carry out a full-fledged assault, supported by all the corps artillery, and as the weather allowed, daily aerial bombing. The Lincoln and Welland Regiment of the 10th Canadian Infantry Brigade was given the lead role.<sup>12</sup> Coincidentally, I had been commissioned in the "Lines" in 1936, and in militia days had run a qualification course for officers that had included Major Jim Swayze, who in January 1945 was the acting commanding officer of the Regiment.

The assault on 26 January was planned as a pincer movement from the east and west ends of the island, with a third force, in canoes, landing behind the enemy position at the harbour.<sup>13</sup> The smoke support was intended to screen the land attacks and the canoe force from observation by positions north of the river. It was also meant to blind the enemy positions on the island until the attacking forces had closed with them. To accomplish this, a mixture of smoke sources was used, including Essos, Beslars, and U.S. Army M4A2 floating smoke pots. In addition British smoke pots were loaded in canoes that were then pushed out onto the river. The wind was easterly as forecast, but very light and variable with the result that the screening effect was not dependable. It never did screen the canoe force. As the Lines war diary stated: "the smoke.. failed to give the proper support at the right spot at the right time."<sup>14</sup> The elaborate plans for the operation changed in the afternoon to a slow, methodical digging out of the enemy, slit trench by slit trench. In this type of action, no role was seen for the smoke unit and it was stood down, but remained in position until noon of the 27th. From the 27th through the 30th the Lines, with the Argyll and Sutherland Highlanders of Canada, supported by the tanks of the South Alberta Regiment, fought against a determined enemy, finally declaring the island cleared of live enemy shortly after midnight 30/31 January. The cost in human life was grim, the Lines having 183 casualties, of which 50 were fatal, including seven officers. The losses of the Argylls and the South Albertas were substantial. The commander of the German defending force, the 6th Parachute

Division, estimated that his casualties were between 300 and 400.

### **Operation "Veritable" The Battle of the Rhineland**

In a paper describing a particular type of support, such as tactical smoke, supplied to a major military operation one must assume that the reader has either some knowledge of the overall campaign or has access to a good textbook describing it. This is particularly true in the case of Operation "Veritable," the object of which was the clearing of the west side of the Rhine River. It is also impractical to describe all the extensions and modifications that were made to the deployment of smoke lines and resources made over the seven-week period during which the screen and its contiguous successors were maintained.

In early January 1945, the Army Headquarters CW staff was tasked to determine how tactical smoke could best be employed in Operation "Veritable." A study clearly showed that screening the activities of the division on the left flank of the operation from observation from the north bank of the Rhine, and in particular from high ground known as Hoch Elten, would contribute substantially to the success of the operation.<sup>16</sup> The discovery some time later of a German panoramic sketch made from an artillery observation post on Hoch Elten confirmed our thinking. A Smoke Group, consisting of Headquarters, Smoke Control, 803 and 810 Smoke Companies of the Royal Pioneer Corps, and 112 Pioneer Company (Smoke), also

of the Royal Pioneer Corps, was assembled. The headquarters was under command of Major J.T. (Temp) Hugill, RCA, with Major Stewart Bastow of the Pioneer Corps coordinating the smoke companies' activities. Captain Peter Claridge, the Technical Officer from 30 Corps, and I were responsible for ensuring that the smoke units' actions produced the desired results, and if not, for altering the plan. The headquarters had its own meteorological officer, Captain Comfort, and a staff captain, Captain Birks, responsible for logistics. When it had been established that our old friends, the 3rd Canadian Infantry Division, was to be on the left flank, we arranged to have a platoon of their Engineers attached, as well as ten Universal Carriers and drivers from 7th Canadian Reconnaissance Regiment (17th Duke of York Royal Canadian Hussars) to move smoke stores in the forward polder country. A radio link on the 3rd Division command net, manned by divisional signalers, was provided. Also four 15 cwt armoured trucks were obtained for smoke line reconnaissance and transport of smoke pots.

The orders from Major-General Dan Spry, the GOC of 3rd Division, were short and to the point: "The Smoke Group will support 3 Canadian Infantry Division by providing a smoke haze over the divisional area." "The best laid plans o' mice an' men gae aft agley" is the best way of describing the start of the operation on 8 February. The flooding of the area from the Rhine to the Nijmegen-Cleve road, and the softening of ground due to a thaw and some rain, made many of the routes planned in January useless. On 3 February alternate plans, based on the land being

*Wainwright Park on the Rhine, February 1945 where the LVT4 Buffloes came to pick up smoke stores. The vehicle on the right is a Buffalo, and to the left is a pue of No.24 pots.*





Photo by Barney J. Glosier, NAC PA 145754

*An aerial view of a smoke screen laid down along the Rhine River near Cleve to hide Canadian troops advancing up to the southern side of the river, 14 February 1945. The extensive flooding of the area is evident in this photo.*

"soft-going," had been developed, and all amphibious vehicles available within 21 Army Group (79th Armoured Division LVTs and Royal Army Service Corps DUKWs) had been earmarked and moved into the Nijmegen area. At this point I must mention the massive smoke screen produced by the massed artillery of about one thousand guns of many calibres. Very early in the morning of 8 February these guns had been employed in harassing enemy headquarters and communications, silencing his artillery and smashing his defences. At 0740 hours, a massive smoke screen was laid down, using all weapons that could fire this ammunition and covering the entire front. Then there was a lull in the firing, during which the sound-ranging units located many enemy artillery locations, because the Germans, expecting an immediate attack, had brought down defensive fire. Following this lull, our artillery resumed fire, concentrating on the identified enemy artillery locations. The time of the actual assault was 1030 hours, but the supporting fire started an hour earlier, with smoke mixed in with the high explosive to conceal the assault battalions of the four divisions as they moved to their start lines.

For the smoke troops, the flooding confined the smoke lines to dikes and the areas to the south of the flooding, such as the towns of Wyler and Donsbruggen. Gaps in the dikes made some sectors inaccessible to the smoke companies, but division headquarters considered the smoke screen to be sufficiently important to allocate 12

LVT4s (Buffalos) to Headquarters Smoke Control on a full time basis. The Buffalos were used to transport smoke stores and also Universal Carriers to the dikes, and then the carriers were used to distribute the smoke pots along the dikes, often under small arms fire from the north of the river.

Driving an LVT along roads covered with water, but not deep enough to float the LVT, proved to be exciting, as many of the roads were mined. On one occasion I thanked "Someone on High" that I had taken the mines course, because I recognized the end of a Regelmine on the road ahead, partly buried in straw and weeds. I was able to scream at the driver who slewed the vehicle. We hit the mine, but only obliquely so we had no one killed, although the driver was badly hurt. Our smoke lines on the outer or winter dikes were attacked by German patrols from north of the river, but these were driven off by the combined action of the infantry and our pioneers.

As the smoke emission line along the dike grew in length it became more and more difficult to supply. Recalling the long screens produced by massed Essos on the Scheldt, I recommended trying the same technique over the flooded land and the Rhine River. We established two points, one each at the villages of Wyler and Donsbruggen, with 12 Essos at each point, and determined under what wind conditions the points should be operated. We also set up a third

point to cater for wind variations. We were blessed with favourable winds almost all the time that the screen was required. As long as the atmosphere was not turbulent, screens up to 15,000 yards were attained. This would not have been possible in the mountainous terrain of Italy or the hot summer conditions of Normandy.

The screen, which was operated originally to defeat enemy observation of our attacking troops, assumed a secondary role - that of concealing the Corps Forward Maintenance Centre in and around Cleve. This required a screen to be continuously effective throughout the daylight hours, as once located through a gap in a screen, supply dumps could be fired on even after the screen had been re-established. Camouflage of the dumps and the layout of dummy dumps helped to reduce this hazard somewhat.

The combined Anglo-Canadian force, according to C.P. Stacey, slowly clawed its way upstream on the southeast bank of the Rhine, by 20 February having only advanced between

15 and 20 miles from the start-line, with the enemy still maintaining an unbroken front. Ahead of our troops lay the formidable defensive line known as the Hochwald Layback. It consisted of several lines of entrenchments, about one-half mile apart, with anti-tank ditches and wire between the trenches. Rather than continuing to push forward with the same divisions, Lieutenant-General Guy Simonds, GOC II Canadian Corps, decided to launch a fresh offensive called "Blockbuster" using 4th Canadian and 11th British Armoured Divisions. The first objective of this thrust, made on 26 February, was to secure the ridge between (idem and Calcar with the ultimate objective being the capture of the Xanten area. No call for smoke to support this action was made until 7 March, when the 129th Brigade of the 43rd Division, which was on the extreme left flank of the front, hard against the Rhine, asked for a screen to conceal its attack towards Xanten. The enemy fire was coming from the other side of the Rhine, and the probable fire control was from one or more observation posts located in tall buildings

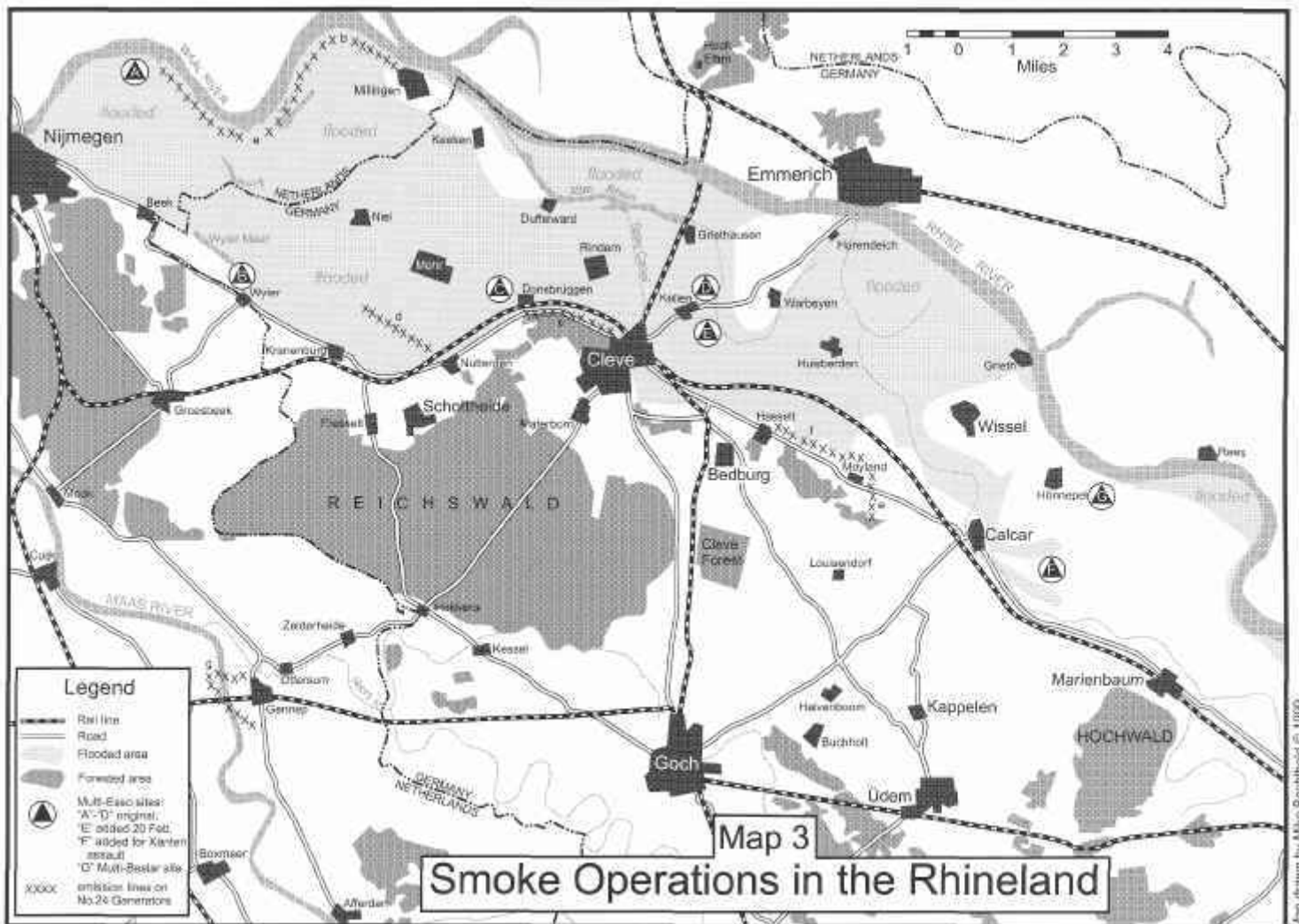




Photo by D.I. Grant, NAC PA 145744

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*The effectiveness of smoke screens at masking ground operations is apparent from this aerial view of the battlefield near Udem, 15 March 1945.*

in the town of Bislich (on the east bank of the river). A Smoke Control was located at the brigade headquarters and 803 Smoke Company established two smoke points, one with 11 Essos, and the other with 24 Beslars (Esso's little brother) well behind the start line, and very close to the river. On the morning of the 8th, the wind was from the northwest as predicted, and the screen carried along the river beautifully, blanketing Bislich but not obscuring the brigade start line or the vision of the direct fire weapons supporting the attack. Although much of Xanten was cleared on the 8th, the screen was maintained through the 9th and 10th to conceal the main road from Marienbaum to Xanten from observed fire.

On a personal note, I must add that I did not plan this screen because I had been in England testing and approving some modifications to the smoke dischargers fitted to the Wasp IIC flamethrowers. I arrived back at Smoke Control to find that 129 Brigade had requested that I run the screen. This was about eight hours before the screen was to be operational. I had not realized until then what a strain it was to be suddenly rushed into action after being out of it for two or three days. In spite of the strange feeling in my stomach, and thanks to a Captain Davies of the Pioneer Smoke Company, we managed to please our customer, and I believe, substantially reduce both observed enemy fire and casualties therefrom.

### Screens in Support of 30 Corps

While the northern or left flank of the Allied assault was being obscured from enemy observation by a comparatively massive screen, 30 British Corps, and in particular its 51st Highland Division, was having water trouble several miles to the south. This was due to flooded land, a swollen River Niers, and blown bridges. Late on 12 February, I was detailed, with a detachment of the 112 Pioneer Company (Smoke), to try at first light, the next day, to "smoke" a damaged bridge and bridging site in the town of Gennepe. On arrival it was obvious that, with the existing wind and rain conditions, the smoke points had to be located where the land was flooded. We found two engineer assault boats, put a layer of wet earth in the boats for insulation and loaded the boats with smoke pots (no floating pots being available). Because I did know something about canoes and boats and paddles, whereas the Pioneer officer could not even swim, I got the boat out to position with the help of a couple of Pioneers and lit the pots. The plan was to resupply with a second boat but, due to an inexperienced crew, the second boat did not arrive to take us off our craft until after an alert German Forward Observation Officer had used us for target practice. The shelling got close to us, but fortunately we had no casualties. By mid-morning the wind had changed, and a screen was maintained all day by more conventional means. On request the screen was kept going the following day to conceal traffic using the bridges.

Evidently these troops, or their commanders, thought that smoke was useful, because we were asked to put up a screen to cover their main maintenance route between Gennep and Hekkens, both of which are located southwest of the Reichswald Forest

### **Operation "Plunder" The Rhine Crossing**

With the final clearing of the west bank of the Rhine, all activity was devoted to the preparation of men and material for the actual assault across the Rhine. During the conduct of Operation "Veritable," II Canadian Corps had established a Forward Maintenance Centre (FMC) in the Cleve area and this had been screened from enemy observation from Hoch Elten since the early days of that operation. On 10 March Second British Army took over the Rhine bank from Emmerich south to Buderich. An integral part of the build-up was a large-scale deception plan to lead the enemy into believing that the assault would be in the Emmerich area, whereas the actual crossing was planned for an area further south near Bislich and Rees. For this plan, gun areas and material stocks around Cleve were largely dummy, while the real ones to the south were very carefully concealed and camouflaged. An elaborate smoke screen was operated from west of Cleve up the Rhine to near Xanten, where it joined a U.S. Army screen covering the American sector. This screen made headlines in the British Army newspaper "Soldier," and in English newspapers generally, as a "man-made sixty six mile long fog." Realizing that a cessation of smoke might be interpreted by the enemy as meaning that an assault was imminent, a plan to keep the enemy guessing was devised by instituting a schedule of "smoke" and "no-smoke" days. It was also hoped that this action might draw enemy fire and thus assist in locating enemy artillery locations for counter-battery purposes.

Because II Canadian Corps was not involved in the initial amphibious assault on 23 March, the Smoke Control Headquarters, and most of the smoke companies, were transferred to the operational control of Second British Army. This was accomplished with no confusion, or loss of effectiveness. We did have one problem on 24 March when the smoke interfered with the airborne landing east of the Rhine in the area of Hamminkeln. The landing was at 1000 hours, as

planned, and the orders we had received were to have the smoke clear of the landing zones by that time. We had anticipated this, when the day dawned with practically no wind, by cutting off all smoke generation by 0700 hours; but some smoke was still hanging in the drop zone at the time of the landing. In 1995 I met one of the glider pilots in Ottawa at the Canadian War Museum and he confirmed that the smoke had been a problem in identifying the landing zone. In this operation the role of the smoke was more deceptive than protective, but it was considered by the formation commanders to have been a contributing factor to the success of the operation.

### **The Support of Canal Crossings**

After the Rhine crossing in late March the operations of II Canadian Corps became more fluid as the advance veered northwards. The country was interlaced with canals, some large and some small. Regardless of the width of the canal, unless a bridge could be seized, it was necessary for the infantry to establish a bridgehead by assault boat or by using the remains of a partially demolished bridge. As soon as possible a Bailey bridge was constructed. Almost all of these crossings were opposed, some of them bitterly, as George Blackburn describes in his *The Guns of Victory* in writing about the crossing of the Twente canal near the village of Almen by the 2nd Division.<sup>16</sup> On the evening of 3 April I was ordered to screen this bridging site, and to establish any dummy or decoy screens that I might think would divert enemy fire. A detachment of 803 Smoke Company, using a combination of smoke pots and floating pots to both the east and west of the bridging site, was ready to make smoke at 0700 hours, but we were requested not to start smoke at that time. At about 1000 hours, enemy shelling began and smoke was called for. The screen was lit, as was a dummy some distance to the east, where there was another possible bridging site. The screens were maintained until last light 6 April when the danger of enemy fire had abated. I must give due credit to the officers and men of the Royal Regiment of Canada who made the initial crossing, and to the Forward Observation Officer of 4 RCHA who accompanied them. This was one of the crossings that was very bitterly opposed!



*Esso generator emitting smoke in the town of Wyler on the Dutch-German border, 10-12 February 1945.*

maintained until the assaulting troops were "firm on the ground." As the assault was westward and the wind was extremely variable, a joint smoke plan was worked out with the divisional artillery, whereby the guns undertook to produce the far side of the box and we, using mainly smoke pots, provided its sides.<sup>17</sup> Again, to cater for wind changes, both in speed and direction, other plans were arranged with the artillery. This too was the first opportunity to make use of a new "toy," a 4-inch naval smoke mortar, which lobbed a ten pound smoke pot up to about 2,000 yards. This was used to provide temporary smoke cover under which a normal smoke point could be established and dug in. The mortar was fired from the bed of my 15 cwt. armoured truck, and worked very well. An interesting point about this smoke operation is that it was the first time it was possible to make a fair comparison in the tonnages of smoke stores and ammunition. The artillery fired about 100 tons of smoke ammunition and we used between 10 and 11 tons of smoke stores. In this operation the artillery screen was about half the length of the of the generator screen, and was of slightly shorter duration. Of course, the artillery was invaluable in reaching points that we could not.

Two other bridging operations were similarly supported, using the same smoke company: one, on 6 April, a second crossing of the Twente Canal by 7 Brigade of the 3rd Division; and the other, on 8 April, a crossing of a nearby canal by 6 Brigade of the 2nd Division. In all these cases the troops claimed that we reduced casualties substantially.

### **Operation "Cannonshot"**

#### **Crossing the Ijssel River**

The last major smoke screen conducted under the auspices of II Canadian Corps was in the liberation of the Netherlands. This was in support of the 1st Canadian Infantry Division, freshly arrived from Italy, which had come under command of the corps for the purpose of clearing the enemy from an area west of the Ijssel River and striking westwards to Apeldoorn. The crossing was to be about five miles north of the city of Zutphen, on 11 April at 1630 hours. The crossing was made using LVTs and assault boats.

The screening requirement was for a smoke box around the proposed bridgehead, to be

The screen was modified several times as the wind veered and backed, and the cooperative effort with the gunners, based on the pre-planned alternatives, worked well. There was shelling into the bridging area, but it was determined that it was part of a predicted fire plan and not observed fire. The screen was maintained until dark, with the exception of part of the artillery screen. The next morning all screening on the right flank was discontinued, but the southern flank screen was maintained because a probable enemy observation post in the outskirts of Zutphen was still in German hands.

### **Operation "Anger"**

#### **The Assault on Arnhem**

While II Canadian Corps was moving northward after crossing the Rhine at Emmerich, I Canadian Corps which had just arrived from the Italian Campaign was given the task of capturing Arnhem. This move had left the island between Arnhem and Nijmegen in the

hands of the British 49th Division and the 12th Manitoba Dragoons. The south bank of the Neder Rijn was cleared by 2 April by a mix of Canadian and British units, but offensive action to take Arnhem was delayed some 10 days in order to coordinate the attack with operations north of Emmerich. The original plan called for a crossing of the Rhine to the west of Arnhem and a smoke screen to conceal preparations for the assault was established, stretching from Randwijk, about 10 miles west of Arnhem, along the south bank of the Neder Rijn, to Huissen, south of Arnhem. It was envisaged that the screen would be required for about 10 days. Because the area to be smoked was continuously occupied by our troops, smoke pots were not to be used due to the irritancy of their smoke. The smoke plan adopted was to establish several "beaming points," with Essos to cover the western sector of the screen, and a line of Essos running northwest from Huissen for the eastern sector.

When the assault plan was changed to an attack from Westerwoort (which is southeast of and across the IJssel River from Arnhem), it was decided to maintain the screen to deceive the Germans as to the point of the attack. This deception was improved by having heavy and noisy vehicle movement in the Driel area. This screen was operated from 2 April until the afternoon of the 14th, and it did divert German artillery fire from the real crossing site. The operational order called for artillery smoke to screen the right flank of the crossing of the IJssel. To reduce the requirement for smoke ammunition and to free the artillery for high explosive shoots, a smoke source was established, but not started on the 13th due to unfavourable winds. The artillery expended 30,000 smoke shells in maintaining this screen for the daylight hours of the 13th and early morning of the 14th, when the wind allowed the generator smoke screen to be effective. Smoke was continued until late afternoon on the 14th when it was considered that Arnhem and its suburbs were completely cleared of German troops.

This smoke operation was conducted by Captain G.K. Wright of I Canadian Corps Headquarters with a small Headquarters Smoke Control complete with a meteorological officer and communications personnel. The Royal

Pioneer Smoke Companies involved were the 810 and 845 and a detachment of the 803. Total casualties in the smoke companies were eight wounded, none of which were fatal. In spite of the inability to conduct the smoke operation completely as planned, due to the wind, it was considered a success.

## **Operation "Duck"**

### **The Assault on the Town of Leer**

**T**he 3rd Canadian Infantry Division, in its drive northwards into the western portion of the Wilhelmshaven peninsula to capture Emden, had first to clear a crossing of the Ems River and capture the town of Leer which was located at the junction of the Leda and Ems Rivers. Smoke support was requested by Brigadier Rockingham, commanding 9th Canadian Infantry Brigade. H-hour for the assault across the Ems River was 1500 hours on 28 April. Smoke was planned for and started at 1430 hours, but was only marginally effective because the wind was extremely variable and grew more so, losing direction altogether. With the approval of the brigade commander, the smoke was cut off in the various sectors, as the smoke from each sector threatened to interfere with the operation.

Thus ended, on a somewhat less than perfect note, the smoke operations of II Canadian Corps and the screens that had grown to be on an army scale, or were contagious, being copied by flanking formations. In conclusion, besides the other smoke staff and our faithful Royal Pioneer Corps companies, I must thank Major-General Elliot Rodger, C.B.E., Chief of Staff, II Canadian Corps, for his support throughout the entire campaign. He always asked me for my opinion as to whether a request for smoke support could be expected to be filled, and at what cost. An example of this occurred a few days before VE-Day, when the 1st Polish Armoured Division, on the right flank of the 3rd Canadian Infantry Division, asked for smoke support for their crossing of the Leda River. As usual, I made a reconnaissance of the area and reported that if we took on the job we were bound to have heavy casualties and had only a very low probability of doing any good. General Rodger accepted my appreciation and told the Poles that a screen was "not on." It is highly probable that his decision saved my life!

## Notes

This paper is primarily based on a 1945 report on the smoke screens which in turn was composed of edited reports on the individual operations, several of which I was the author. "Report on Smoke Screens carried out by First Canadian Army in Northwest Europe 1944-1945" by Lieutenant-Colonel W.R. Sawyer and staff, published 15 July 1945, by Headquarters First Canadian Army in the Field. Reference to it is not annotated in the text. Three volumes of the Official History of the Canadian Army in the Second World War were used to provide background to the individual smoke operations.

1. C.P. Stacey, *Six Years of War: The Army in Canada, Britain and the Pacific* (Ottawa: The Queen's Printer, 1955), p.347 et seq.
2. G.W.L. Nicholson, *The Canadians in Italy: 1943-1945* (Ottawa: The Queen's Printer, 1956), pp.411, 533, 535, 546, 553, 590, 615, 630, 637 and 639.
3. B. Greenhous, "Dragoon" *The Centennial History of the Royal Canadian Dragoons 1883-1983* (Ottawa; the Guild of the Royal Canadian Dragoons, 1983), pp.337-338.
4. E.H. Rhodes-Wood, *A War History of the Royal Pioneer Corps 1939-1945* (London: Gale and Polden Ltd., 1960), p.233.
5. C.P. Stacey, *The Victory Campaign: The Operations in North-West Europe 1944-1945* (Ottawa: The Queen's Printer, 1960), p.348.
6. *Ibid.*, p.393.
7. *Ibid.*, pp.395-396.
8. *Ibid.*, p.401.
9. Rhodes-Wood, p.264.
10. *Ibid.*, pp.264, 265.
11. Stacey, p.431.
12. Geoff Hayes, *The Lines: A History of the Lincoln and Welland Regiment at War* (Alma, ON: Maple Leaf Route Publishing, 1986), Ch.5.
13. Stacey, p.453.
14. War Diary, Lincoln and Welland Regiment, National Archives of Canada, Record Group 24, Vol. 15,103.
15. Stacey, pp.480-481.
16. George Blackburn, *The Guns of Victory* (Toronto: McClelland & Stewart, 1996), p.410ff.
17. Stacey, p.551.



Colonel J.C. Bond, MC, CD (ret'd) [at left shown standing beside a Beslar Smoke Generator in the collection of the CWM] served as Technical Staff Officer (CW) HQ 2nd Canadian Corps. Jim Bond continued to serve in the Canadian army after the war, specializing in chemical warfare and smoke screens. He retired in 1958 in the rank of colonel. He lives in Ottawa and is an active member of the Friends of the Canadian War Museum.