A DESCRIPTIVE AND CRITICAL SURVEY OF THE CIVIL DEFENCE ANTI-GAS (CASUALTY) SERVICES IN SCOTLAND
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AIR RAID PRECAUTIONS CASUALTY SERVICES
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AIR RAID PRECAUTIONS CASUALTY SERVICES.

HOME OFFICE SCHEME OF MEDICAL ANTI-GAS INSTRUCTION.

The activities of the Air Raid Precautions Department of the Home Office became public in the second half of 1936 under the direction of Wing Commander J. Hodson, C.B., the Medical Branch of the organisation in these early days largely centring round one man, Major Stewart Blackmore, R.A.M.C.

By the end of 1936 the Home Office Anti-Gas School at Falfield had turned out its first hundred or so Anti-Gas Instructors including doctors, officials of Local Authorities, and officers of the Police Force and Red Cross. Having qualified after an intensive course of instruction these were in their turn organising the first local classes for the instruction of the personnel of their own areas. For the use of instructors-in-training at the Anti-Gas School, and subsequently for the training of the A.R.P. personnel of Local Authorities, official text-books, Air Raid Precautions Handbooks, had already been published or were in course of preparation. Early in 1937 were published Air Raid Precautions Handbooks Nos. 1, 2 and 3 on "Personal Protection Against Gas", "First Aid and Nursing for Gas Casualties" and "Medical Treatment of Gas Casualties", and Memorandum
No. 1 on the "Organisation of Air Raid Casualties Services".

The initial A.R.P. instruction placed the emphasis on anti-gas precautions. The Home Office declared the immediate aim of the government to include the providing of respirators free to every member of the civilian population, and the gas-proof room was emphasised as an essential of every household. Soon the police services throughout the country were supplied, through the Falfield School, with a sufficient number of their officers qualified as anti-gas instructors to achieve the rapid completion of the training of all police forces. It was official opinion that, in the event of an Emergency, heavy and large scale air attack on our cities would be an early risk, hence the urgency of the training of the police forces on whose efficiency much might depend in the maintenance of order and morale among the civilian population.

So important and pressing did the Home Office regard the need for precautions against the air raid peril that it decided to ensure the immediate training of the medical profession also by taking this responsibility upon itself. The outcome was the Scheme of Medical Anti-Gas Instruction initiated
in July of 1936 and later outlined in Air Raid Precautions Memorandum No. 5, "Anti-Gas Training".

Sixteen qualified medical practitioners were at that time selected by the Secretary of State for training at the Home Office Anti-Gas School, Falfield, and were duly appointed Home Office Medical Anti-Gas Instructors, for the sole purpose of giving instruction to the medical, dental, veterinary and nursing professions. By arrangement with the British Medical Association the local officers of that Association co-operated in the organising of local courses of instruction for general practitioners. Arrangements for instruction at Medical Schools were made with the Deans; with the College of Nurses and the Medical Superintendents and Matrons of hospitals for the training of nurses, and with Medical Officers of Health for the training of the staffs of Local Authority hospitals. Under the Scheme instruction and training equipment such as respirators, protective clothing, models and charts were provided free by the Home Office and no responsibility for either financing or organising fell on the Local Authorities. The only cost which did sometimes fall to be met locally, in the case of doctors only, was that of accommodation for local classes and the minor expense of organisation, and
this was usually met by a fee of 2/6 to 5/- charged to those attending the course.

This Scheme of Medical Anti-Gas Training continued in full operation throughout the country until the outbreak of war in 1939. Of the sixteen Home Office Medical Anti-Gas Instructors - later to be increased in number - three were allocated to Scotland, the writer being the one appointed and made responsible for the eastern half of Scotland.

During the three years 1936-39, to speak of this area alone, all the medical profession including not only doctors but also final-year medical students, nurses, dentists, veterinary surgeons, health visitors, sanitary inspectors and chemists, were given the opportunity of a course of training in Medical Anti-Gas Precautions consisting of six or seven two-hour weekly lectures, arranged at hours and centres suitable to the students. About 1,000 doctors and 3,000 nurses in the area took advantage of this instruction. The Course consisted essentially of theory and practical instruction. The theoretical lectures covered the War Gases, Individual Protection, Collective Protection, Decontamination and the Air Raid Precautions Organisation. The practical instruction included fitting and wearing of the respirator, four hours of
respirator drill, demonstrations of medical de-
contamination, wearing of anti-gas clothing, and so on.
(See Appendix I for Syllabus of Course).

Major Blackmore had at one time, no doubt, visions of a separate Air Raid Precautions Medical Service with himself at its head. The rapid developments made in all the medical aspects of Air Raid Precautions in these early months bore ample testimony to his own expert knowledge, his organising genius and his inspiring leadership, but in 1937 he died from overwork and Air Raid Precautions lost its expert medical organiser and chief. The consequences of this misfortune to Air Raid Precautions in Britain have been far reaching for, to the present day, no person or combination of persons has been found to fill his place.

From Major Blackmore's death up to the end of 1938 medical developments in the A.R.P. organisation were uneventful. No major modifications took place but the lack of a medical chief in the A.R.P. Department became more and more felt. The Scheme of Medical Anti-Gas Training continued along the prescribed lines. At that time local A.R.P. schemes existed almost entirely on paper. The country as a whole did not realise the danger of war. Events in
the Civil War in Spain did, however, bring a shifting of the emphasis from gas to the high-explosive danger in air warfare; then came the crisis of the autumn of 1938. It cannot be said that this wakened the country up thoroughly but it did result in a speed-up in the development of A.R.P. schemes throughout Scotland. One major decision vitally affected the medical A.R.P. organisation, the transference of the A.R.P. Casualty Services, with the exception of First Aid Parties, from the Ministry of Home Security to the Ministry of Health in England and to the Department of Health in Scotland. It soon became evident that the Ministry of Health was unsympathetic towards the Home Office Scheme of Medical Anti-Gas Training. On the outbreak of hostilities in 1939 the Home Office decided to suspend the scheme. Since then responsibility for the training of the medical profession in Air Raid Precautions has rested with the Ministry of Health in England and the Department in Scotland. In chapter 4 on Training subsequent developments will be discussed.

After the commencement of war the writer continued to act for the Home Office as Medical A.R.P. Adviser to the Regional Commissioner in Edinburgh, and in 1940 was appointed, in addition, Inspector of
Casualty Services for the East of Scotland by the Department of Health which had in January of the previous year replaced the A.R.P. Department of the Home Office as the Central Authority for these Services in Scotland.

AIR RAID PRECAUTIONS CASUALTY SERVICES.

Air Raid Precautions Memorandum No. 1 published in 1937 first outlined the type of organisation to be set up by Local Authorities to provide a means of treating persons contaminated with gas, whether or not they were also casualties requiring medical treatment. This original A.R.P. Casualty Organisation was based on four essential units: (Mobile) First Aid Party, First Aid Post, Casualty Clearing Hospital and Base Hospital, intended respectively to provide first aid, minor surgery, major surgery and surgical treatment. It included, in addition, a Casualty Ambulance Service operating between Parties, Posts and Hospitals. We have seen that in Scotland all these, with the exception of the First Aid Party organisation which remained under the Home Office, passed under the Department of Health in 1939. The first three of the above mentioned units still form the essential units in the Casualty Services and will now come under consideration individually.
FIRST AID PARTIES.

Each First Aid Party consists of a leader and three men, with a motor car to carry them and their equipment and a fifth person to drive them. Their first aid equipment includes individual pouches and a party haversack containing surgical dressings, and in addition there are splints, tourniquets, stretchers, blankets and water bottles. The personal equipment of each man includes a general service respirator and a suit of protective clothing for his protection against gas. Spare respirators and bleach ointment are carried for the treatment of civilian gas cases. Stretchers are made of metal to facilitate decontamination. First Aid Parties are thus equipped both to permit of their working in poison gas and to enable them to render first aid to poison gas casualties. Personnel of the First Aid Party Service who themselves become contaminated by poison gas require to be cleansed in Personnel Cleansing Centres before resuming their ordinary clothing. In these cleansing centres contaminated protective clothing is removed in the correct manner, eyes receive routine irrigation treatment and bodies are washed with soap and water.

The original Home Office instruction did not envisage the possibility of the employment of doctors with First Aid Parties. It was not thought there
would be a sufficient number of doctors for first aid work but experience under raid conditions has proved the value of skilled medical attention for casualties at the scene of the incident. Scheme-making Authorities have therefore been advised to make arrangements with local doctors to supervise the work of First Aid Parties whenever possible. In the event of extensive raiding there are what are known as MOBILE FIRST AID POSTS which can be utilised to supplement the First Aid Parties at the scene of the incident. These Mobile Posts consist of 'buses or vans containing all the surgical equipment of a Fixed Post, conveniently stored in movable cupboards. Mobile Posts are capable of opening out in any convenient hall or building or in the open. Their staff consists of a doctor, a nurse and eighteen trained auxiliaries.

Stretcher and sitting casualties will be conveyed in the CASUALTY AMBULANCES of which the "stretcher ambulances" usually accommodate four stretcher cases, and "sitting-case cars" (usually motor cars of small horse power) accommodate two to five sitting cases. Some Scheme-making Authorities have grouped the First Aid Party, stretcher ambulance and sitting-case car into what they call a CASUALTY UNIT. There is no objection to this provided that
each of these is self-contained, i.e. the First Aid Party must be complete with its equipment in its own car, and able to be moved independently of the ambulances should that be necessary. Similarly, each ambulance should carry its own complete equipment and be ready to move off alone at a moment's notice. In order that the First Aid Party may be an independent unit the FIRST AID PARTY CAR is supplied with stretcher carriers on the roof capable of taking four stretchers, and a box or basket on the carrier behind for blankets, protective clothing, etc. Pouches, haversacks and splints are usually conveyed with the party inside the car itself. In addition, to enable them to proceed to a distant destination as reinforcements, the party carries iron rations, spare petrol coupons and all the necessary tools for changing wheels, repairing tyres or carrying out minor repairs on the road. AMBULANCES are provided with stretchers and blankets, rations, petrol coupons, etc. in a similar way. Each stretcher ambulance has a driver and an attendant. Sitting-case cars have a driver but no attendant.

During the past year, as a result of experience gained during the heavy raiding that has taken place on our cities from the air, some important changes have been made in the equipment carried by First Aid
Parties. These changes have been mainly additions and include trigg lifts for extracting wounded and trapped casualties, improved lighting in the form of a spotlight fixed to the steel helmet, more large wound dressings, hot water bottles, and ground sheets to the number of eight per party. The equipment of these parties is continually under review by a FIRST AID PARTY EQUIPMENT PANEL which meets in London and of which the writer was, until recently, the Scottish representative.

The number of First Aid Parties was fixed on a scale of roughly from twelve to fifteen parties per 100,000 of the population. This has been found in experience to be an over-estimate. The great majority of casualties from air raids have been trapped by the destruction of the buildings in which they were sheltering and their rescue has only been possible after much clearance work by Rescue Parties. In very many instances the rate of rescue has been as slow as one case per half-hour, and thus it has been found that, while First Aid Parties were more numerous than necessary, the scale of Rescue Parties has been less than the essential minimum. In order to restore the balance between First Aid Parties and Rescue Parties, it has not been decided to reduce the number of First Aid Parties. Instead, a scheme for the
INTER-CHANGEABILITY OF CERTAIN A.R.P. SERVICES has been recommended to Scheme-making Authorities. Already great progress has been made in training First Aid Parties in rescue work and Rescue Parties in first aid work. It is intended that this scheme should be extended to include at least Decontamination Services as well. Thus from a large pool of trained personnel, First Aid Parties or Rescue Parties or Decontamination Parties would be available as necessity arose.

This has, of course, resulted in considerable increase in the equipment of these different services. In addition to their elaborate personal and first aid equipment, First Aid Parties now carry simple items of equipment for rescue work such as picks and shovels, and Rescue Parties have had added to their specialised equipment such surgical dressings and splints, etc. as will enable them to undertake emergency first aid work.

The training of First Aid Parties in anti-gas measures will be considered in chapter 4, and the anti-gas treatment rendered by them to gas casualties will be dealt with in chapter 3. But it may be noted here that it is the First Aid Party, who may or may not be directed in their work by a qualified
doctor, that will be responsible for the initial treatment of gas victims of an air raid and for their correct disposal to Post or Hospital as the case may be.

The Home Office instructions to First Aid Parties regarding the INITIAL DISPOSAL OF CASUALTIES required that they should be competent to distinguish between walking cases and stretcher cases. Stretcher cases were to be sent straight to Hospital, walking cases, on the other hand, to First Aid Posts. "It must be understood that First Aid Parties are not merely and solely stretcher-bearers. They are to be regarded as trained personnel charged with duties important both for the individual casualty and for the smooth running of the system". (Air Raid Precautions Handbook No. 10 p.5).

In Scotland, in 1939, when the Department of Health took over the central control of First Aid Posts and other Casualty Services, one of their first instructions affirmed that First Aid Parties should not attempt to differentiate between cases at the incident, but should send all cases direct from the incident to the First Aid Posts for initial classification and disposal. They ruled that First Aid Party Personnel were insufficiently trained to be
Fig. I INITIAL DISPOSAL
of CASUALTY at INCIDENT (Home Office)

Fig. II A. ALL CASUALTIES from INCIDENT to POST
B. AFTER INCIDENT CLEARED,
SHUTTLECOCK B. SERVICE
- POST to HOSPITAL - OPERATES. DUNDEE (D.H.S.)

Fig. III. INITIAL DISPOSAL by M.O.
in AMBULANCE at POST ENTRANCE. ABERDEEN (D.H.S.)
able to distinguish between the minor and the major surgical case. Acting on the directions in the Air Raid Precautions Handbooks, particularly No. 10, Scheme-making Authorities had already arranged that First Aid Parties should send cases direct either to Hospital or to Post according to their estimated seriousness. (Fig. 1). By their instruction that First Aid Parties send all cases irrespective of injury or condition to First Aid Posts, the Department of Health ignored the existence of these arrangements. The results of the divergence of instructions of the two government departments were very evident in the confused situation that existed during the following two years throughout the East Coast of Scotland. In one of the larger cities, Dundee, (Fig. 2) the Casualty Services were directed that all air raid casualties were to be sent to First Aid Posts and that no casualty ambulances would be available except for service between Incident and Post until the last casualty had been cleared from the streets. Then, and only then, were the casualty ambulances to be available for the second shuttlecock service between Post and Casualty Clearing Hospital. Yet a different scheme obtained in another large city, Aberdeen. (Fig. 3). Here the Casualty Services were instructed to send all casualties to First Aid Posts but it was to be the duty of one of the medical officers of the
First Aid Party to inspect the casualty in the ambulance. This medical officer then decided which cases should be admitted into the Post and which sent on to Hospital. It was hoped that, to conserve the use of ambulances, hospital cases would be changed from one to another in order that no ambulance would have to take the journey to hospital half empty.

In two other cities, Edinburgh and Glasgow, attempts at a compromise of the two policies resulted in different districts of these cities working under differing instructions.

The new rule was further complicated by an exception being introduced in the case of casualties contaminated by mustard gas. Here First Aid Parties were required to distinguish between walking and stretcher cases, the instruction being that all walking contaminated cases be sent to Posts and all stretcher contaminated cases direct to Hospital - recognising that the Post would be unable to handle such cases. No instruction, however, was given with regard to phosgene or lewisite casualties.

It would seem that these had not been mentioned because no solution had been found to the problem they presented.

Fortunately for Scotland, the experience of air
raids gained in England brought about a revisal of the policy of the Department of Health with regard to the initial disposal of casualties and the original instructions of the Home Office are again followed.

First Aid Parties are grouped in FIRST AID PARTY DEPOTS. The Decontamination, Rescue and other essential A.R.P. services are likewise grouped in Depots. Service Depots may be combined-depots for several different services or limited to a single service. The number of Service Depots in any area is proportionate to its size and population. In the case of the Casualty Services, First Aid Party Depots and Ambulance Depots are frequently situated in different parts of the First Aid Post building or in some other building conveniently near. All Service Depots are in telephonic communication with the corresponding Report or Control Centre.

In view of the developing interchangeability between the First Aid Party, Rescue Party and Decontamination Party, and because of the very close association existing between first aid, rescue and decontamination under 'blitz' conditions, it is in place to make some mention here of the two latter Services.
RESCUE PARTIES now consist of nine men and rescue equipment, a lorry and a driver. Their personal equipment includes protective clothing with the service type of respirator. In addition to their rescue equipment they carry a first aid box and, though not so highly trained in first aid as the First Aid Party, they have a useful knowledge of first aid and anti-gas treatment. They are thus mobile, trained and equipped to render first aid to the casualties they rescue, equipped to work in gas and able to render essential preventive and first aid anti-gas treatment.

DECONTAMINATION PARTIES consist of ten men, decontamination equipment and a lorry. The personnel are supplied with the heavy type of protective clothing and the service respirator. Progress in their training in first aid and rescue work is not very far advanced. The personnel are mostly recruited from the local Cleansing Department staffs. Methods of decontamination in which they have been trained are slow, difficult and time-consuming, consisting essentially of preliminary hosing and scrubbing of the contaminated area and subsequent treatment as necessary by bleach and sand, bleach and water, or bleach powder. These methods would be difficult if not impossible during the hours of darkness. Decontamination Parties have been
authorised on a very limited scale, and in general have been recognised as possibly the least satisfactory of our A.R.P. Services.

FIRST AID POSTS (FIXED).

One essential difference between First Aid Posts and First Aid Parties is that, while the Party is mobile and operates at the site of the incident, the First Aid Post is a fixed centre. Its location is known to the population in the area in which it serves and it is therefore capable of being a medical rallying centre for its area.

THE ORIGINAL PLAN OF A FIRST AID POST is described in Air Raid Precautions Memorandum No. 1, "The Organisation of Air Raid Casualties Services", which states that a First Aid Post should be prepared to handle three classes of casualties of each sex. The SECTIONS of the Post in which casualties would be treated according to their class are:

- Section A - wounded or gassed, who are not contaminated with persistent gases,
- Section B - wounded or gassed who are also contaminated with persistent gases,
- Section C - unwounded persons whose skin or clothing is contaminated - who would not be "casualties" at all if they had early decontamination.
FIRST AID POST

SECTION A

WOUNDED AND GASED

(UNCONTAMINATED)

Fig. 4. FROM A.R.P. MEMO. NO. 1.
According to this original arrangement of First Aid Posts, one Section (Section A) had to be kept strictly separate from the other two Sections (Sections B & C). In this way non-contaminated casualties in Section A were kept separate from contaminated casualties, wounded and unwounded, in Sections B & C. These three Sections, A, B & C, had to be duplicated, one for males and one for females.

SECTION A, for the provision of First Aid for uncontaminated casualties, consisted essentially of three rooms. (Fig. 4). The entrance to Room 1 (Reception Room) was by means of an air lock. Room 1 communicated directly with Room 2 (First Aid) which in its turn communicated directly with Room 3 (Waiting Room), and exit from the Section was by means of an air lock leading out of Room 3.

Of these three rooms, No. 2 was the largest and No. 1 the smallest. The reception room was intended to include four stretcher cases in addition to sitting cases and here initial records of the cases were obtained, name, address, etc. In Room 2 it was intended to provide accommodation in a large Post for six stretcher and six sitting cases and, in a smaller Post for four stretcher and four sitting cases. In this room, sinks, hot water, a simple sterilizing
FIRST AID POST

SECTION B

WOUNDED AND GASED

(CONTAMINATED)

Fig. 5. FROM A.R.P. MEMO. NO. 1.
apparatus, shelves and cupboards were provided. In Room 3 casualties would be accommodated while waiting for discharge to hospital or in order to rest before proceeding home. Facilities were to be available here for supplying hot drinks and other light refreshments.

SECTION B, for the provision of cleansing treatment for contaminated casualties, was intended to handle surgical cases also contaminated by persistent gases. Entrance to the reception-undressing room was by means of an air lock, but in addition to the reception room, an open shed was provided beside the air lock. (Fig. 5). Casualties were received in the open shed. They proceeded via the air lock to the reception room from which they were passed to Room No. 2 via a second air lock. Room No. 2 communicated directly with Room No. 3, Room No. 3 in a similar manner with Room No. 4 and exit was obtained through an air lock leading from this last room. The open shed was to be utilised for the removal of grossly contaminated outer garments to reduce the amount of vapour brought in with the patient. The reception-undressing room was intended to accommodate two stretcher and six sitting cases. In this room the patients were undressed. Contaminated clothing was deposited in bins with close-fitting
FIRST AID POST

SECTION C

UNWOUNDED
(CONTAMINATED)

Fig. 6. FROM A.R.P. MEMO. NO. 1.
lids. Room 2, the Washing Room of the Section, was supplied with washing facilities in order that patients could be washed with soap and water. In addition to the washing of the skin, eye irrigation was to be given in this room. The next room, Room 3, was the First Aid Room, similar in equipment to Room 2 of Section A and, if possible, combined with that room. The last room of this Section, the Dressing and Waiting room, differed from Room 3 of Section A in that it contained a clothes' store with clean clothing, in order that the now cleansed patients might be suitably clothed before discharge to hospital or home, as the case might be.

SECTION C, for the treatment of unwounded, contaminated persons, differed from the preceding one in that it had no First Aid Room. (Fig. 6). The open shed led through an air lock to a large undressing room, which communicated via a second air lock with the washing room, which in its turn communicated with a large dressing room. Exit to the exterior was again through an air lock leading from Room 3. Unwounded casualties directed to this Section would leave grossly contaminated clothing in the open shed, proceed to the undressing room in their underclothing, there be completely stripped and directed to the washing room. Here, by means of showers and soap,
FIRST AID POST

LAYOUT SHOWING ACCOMMODATION FOR ONE SEX ONLY

SECTION A
WOUNDED AND GASSLED
(UNCONTAMINATED)

FIRST AID

WAITING

RECEPTION

SLOP SINK

AIR LOCK

W.C.

SECTION B
WOUNDED AND GASSLED
(CONTAMINATED)

B 3
FIRST AID

WASHING

DRESSING

B 4

AIR LOCK

W.C.

SECTION C
UNWOUNDED
(CONTAMINATED)

C 1
UNDRESSING

OPEN SHED

C 2
UNDRESSING

C 3
WASHING

DRESSING

CLOTHING STORE

AIR LOCK

Fig. 7. FROM A.R.P. MEMO. No. 1.
the body surface would be thoroughly cleansed and eyes would receive routine irrigation. Unwounded casualties would then be received in the dressing room and supplied with clothing to enable them to return home or to proceed to a Rest Centre.

The official diagram illustrating the lay-out of one complete Section of a Post (A, B and C) is given opposite. (Fig. 7). From this diagram it will be observed that in its original conception a First Aid Post was very complicated. There were for each sex three entrances, one "clean" and two "dirty". Not only were the contaminated and uncontaminated casualties separate but the contaminated wounded were separate from the contaminated unwounded.

Considerable MODIFICATIONS IN THE ORIGINAL LAY-OUT of a First Aid Post, as described above, have been made by the Department of Health for Scotland, resulting chiefly in a single large Surgical Section (A) for both sexes, Section A now accommodating all male and female uncontaminated wounded and gassed casualties, and in Sections B and C being united into one Section for the accommodation of both injured and uninjured contaminated. The simplification has, therefore, produced a First Aid Post with only three Sections in it, (Fig. 8), Section 1 Surgical.
FIRST AID POST

LAYOUT WITH ONE COMBINED SURGICAL SECTION AND SEPARATE MALE AND FEMALE CLEANSING SECTIONS

Fig. 8.
for both male and female uncontaminated; Sections 2 and 3 Cleansing or Anti-Gas, for male and female wounded or unwounded contaminated casualties.

The original arrangement whereby wounded and unwounded contaminated cases were kept separate, at least in the undressing and washing stages, took account of the obvious difficulty of attending to wounded and unwounded casualties together in the same place. It also permitted, and afforded facilities for, the handling of stretcher contaminated cases in the First Aid Post. Under the new arrangement which now obtains, no provision whatever is made at Posts for the stretcher contaminated case. In the event of such stretcher cases arriving at a First Aid Post - and in heavy raiding, and at night, this must be expected - it will not be possible under existing arrangements for them to be treated except by a temporary suspension of the normal activities of the Cleansing Sections of the Post. Again, if walking injured and uninjured are mixed together in the procession through the Cleansing Section of the Post, it is difficult to see how the flow of patients can be maintained. Serious delay might result, possibly also confusion.

The problem contemplated above has influenced
the Home Office in effecting provision of CLEANSING CENTRES on a scale of twelve batteries of showers per square mile in congested areas. In addition to these fixed Cleansing Centres, MOBILE CLEANSING UNITS of an approved pattern are being produced by the Home Office, and these would be available to supplement the work at Posts or to act independently as required. A still further provision has been made in that a certain percentage of chemists' shops in all the larger centres of population have been provided with facilities, pails, bleach powder, etc., for the preparation of bleach cream for public use. The arrangement is that the cream should be placed in pails outside the shops by the chemists, with directions to the public on its use displayed prominently. In Chapter 3 more recent proposals made by the Home Office inviting householders to assist the A.R.P. Services in the cleansing of contaminated cases will be discussed. All these arrangements have as their aim the cleansing of the uninjured casualty in some place other than a Post.

First Aid Posts are, in the main, of two sizes, small and large. The 40-Personnel are small Posts and the 60-Personnel are large Posts. The STAFF of a First Aid Post consists of at least two doctors, if possible, one trained nurse and forty or sixty A.R.P. personnel. In the larger cities a certain
proportion of the staff is 'full time', the rest being voluntary workers giving so many hours a week of voluntary service. Those personnel allocated to the Cleansing or Anti-Gas Sections of the Post are provided with the necessary protective equipment, respirators, etc. for their own protection against gas on the contaminated patients they may have to handle.

CASUALTY CLEARING HOSPITALS. It was originally specified in Air Raid Precautions Memorandum No. 1 that in a Casualty Clearing Hospital the type of CLEANSING ACCOMMODATION for injured persons who are also contaminated before their admission to the wards would follow the lines of Rooms B1 and B2 of a First Aid Post. This arrangement, it will be remembered, provided separate accommodation for injured contaminated and uninjured contaminated casualties, and duplicated this provision in order that the sexes might be separate.

During 1939 and 1940 there was no cleansing provision in the hospitals of Scotland. Such provision as was eventually made was the result of persistent representations to the Department of Health by the governing authorities of the hospitals concerned, though without any definite policy developing. Today
CLEANSING SECTIONS OF CASUALTY CLEARING HOSPITALS

**Fig. 9.**

**Fig. 10.**

**Fig. 11.**
are to be found up and down the country so-called Cleansing Centres ranging from a small outer shed consisting of a roof and two supporting poles leading into an ordinary immersion bath (Fig. 9), to the more elaborated system of having a detached outer shed completely open except for a protecting wall of cloth and leading across open ground to undressing, washing and drying rooms (Figs. 10 and 11). Even yet many key hospitals have not been provided with cleansing facilities.

In a letter to Medical Officers of Health the Department characterised liquid mustard gas as being so penetrating to clothing and so lethal in its effect that the only hope for the victim lay in immediately tearing off all clothing. Unless this drastic treatment was carried through in time to prevent the mustard gas reaching the body the person was 'doomed'. It is not surprising that, based on this theory, the procedure resulting laid all the emphasis on contamination and, the patient being regarded as 'doomed' in any case, the main objective of his treatment was to prevent contamination from entering the hospital. The casualty, no matter how severely injured, was to be stripped of all contaminated outer clothing in an open shed. If the number of cases made immediate attention impossible, the
CLEANSING SECTION OF CASUALTY CLEARING HOSPITAL

SHOWING PROXIMITY OF CLEANSING SECTION TO HOSPITAL RECEPTION ROOM. AS IN ULSTER.

(Note Improvement on Figs. 9, 10 and 11)
casualties were to be laid in rows in the open until such time as they could be attended to. Having had the outer clothing removed in the open shed, in some cases separated from the hospital by many yards, they were then to be carried to another shed, very well ventilated, in which the remainder of the clothing was to be removed. In this shed urgent treatment, the administration of morphia etc., and the irrigation of the eyes were to be provided for. Before being removed from this outer shed to the washing room, the patient was to be transferred to a clean stretcher without blankets or covering, then carried into the washing room and here given a thorough soaping and washing in warm water. This drastic procedure of cleansing completed, the casualty, if still alive, was now to be permitted to enter the hospital proper in order that such surgical attention as his condition required might be given him. That this procedure holds even yet in many hospitals in Scotland will be seen in Chapter 3. (Contrast Diagram on p. 36).

The PERSONNEL for the operation of their Cleansing Centres is a problem to many hospitals. The casualties will include a large proportion of major surgical cases that will have to be handled by trained nursing staff. The undressing and washing of such serious cases could not be undertaken by the
untrained. Suitable personnel for First Aid Parties and First Aid Posts can be recruited from all walks of life. Their acquisition and their training in first aid and anti-gas does not present a problem comparable with that of the Casualty Clearing Hospital which has to provide trained nursing personnel for serious stretcher cases. A minimum staff of one doctor, two sisters and sixteen trained nurses would be required. The protective equipment supplied to such of them as are handling a contaminated case in the outer shed and undressing room is the usual light protective clothing suit and civilian duty respirator, equipment of the First Aid Post.
CHAPTER II

OPERATIONAL CONTROL AND COMMUNICATIONS

OF THE

CIVIL DEFENCE ORGANISATION
CHAPTER II.

THE COMMUNICATIONS OF THE CIVIL DEFENCE ORGANISATION.

The Civil Defence Medical Services of Scotland are controlled centrally by the Ministry of Home Security and the Department of Health for Scotland. The Scheme-making Authorities are responsible, under these Central Authorities, for the organisation and operation of the local A.R.P. schemes throughout the country. Policy, establishment, equipment, expenditure, training etc. are controlled by the Central Authorities. Scheme-making Authorities receive assistance in their Air Raid Precautions expenditure by government grants which amount to from 70% to 100% of the costs involved, e.g. the full cost of shelters falls on the Government. Scheme-making Authorities to qualify for government financial assistance must obtain the approval of the Central Authorities for all schemes and expenditure.

THE MINISTRY OF HOME SECURITY. (OPERATIONAL CONTROL)

Under this Ministry England, Scotland and Wales have been divided into twelve REGIONS. Each Region has its Regional Office, its Regional Commissioner and a full staff of Civil Servants, Principal Officers, Regional Officers etc., and close liaison is maintained between the different Regional Offices and between these and the Fighting Services and the other govern-
ment departments of Scotland. The SCOTTISH REGION, which comprises Region 11, has its Regional Office in Edinburgh. It differs from other Regions in that it has been divided, because of its geographical extent, into five DISTRICTS, each with a District Commissioner and staff. These District Officers are located in Inverness, Aberdeen, Dundee, Glasgow and Edinburgh.

Local operational control of the Civil Defence Services in action is centred in the CONTROL CENTRE of the Scheme-making Authority. District and Regional operational control are centred in the War Rooms of the corresponding District and Regional Offices. Thus essential control is operated from three centres, Region, District and Control Centre, all in direct touch with each other enabling immediate and continuous Communication from periphery to centre and Control from centre to periphery.

SCHEME-MAKING AUTHORITIES. (OPERATIONAL CONTROL)

Under the Air Raid Precautions Act of 1937 certain local authorities were required to prepare and submit to the Home Office for its approval plans for comprehensive A.R.P. Schemes. Such local authorities are known as Scheme-making Authorities. In Scotland the main Scheme-making Authorities consist of the County, City and larger Burgh Councils. It is
OPERATIONAL CONTROL

EDINBURGH AND S.E. DISTRICT - CONSISTING OF THE SCHEME-MAKING AUTHORITIES OF THE THREE LOTHIANS, EDINBURGH, ETC.

R.C. - Regional Commissioner (Ministry of Home Security)
D.C. - District Commissioner (do)
C.C. - Control Centre (Scheme-making Authority)

Fig. 12.
the procedure for these Scheme-making Authorities to delegate their responsibilities to A.R.P. EXECUTIVE COMMITTEES elected from their own number. Such a Committee consists of a Chairman and two members. In the local A.R.P. scheme the different services are in charge of the corresponding Local Authority Officials, e.g. the Casualty Services are under the Medical Officer of Health, Repair and Demolition under the City Engineer, and so on. These Local Authority officials in charge of A.R.P. Services are known as HEADS OF SERVICES. In addition, the A.R.P. Committee appoints an A.R.P. CONTROLLER who has his headquarters in the Control Centre (Fig. 12).

It will be noted that this diagram (Fig. 12) shows the three essential lines in the OPERATIONAL CONTROL in Scotland to be:— (1) Regional Commissioner, Edinburgh, to (2) District Commissioners, Inverness, Aberdeen, Dundee, Glasgow and Edinburgh, to (3) Control Centres of Scheme-making Authorities, and these three Operational Centres permit all the necessary contact and control between London and every part of the A.R.P. organisation of the country.

The CONTROL CENTRE, from which the Heads of Services operate, on a scheme of one to every five hundred thousand or under of the population is, as we
have just seen, the place where communications between the Controller and the District Commissioner are handled, and it is here that are compiled such reports and statistics as the Controller has to furnish to the District Commissioner. The Control Centre exercises general control of all available resources during attack, and arranges for mutual support between its Report Centre areas (vide infra). The Heads of Services, or their representatives should be at the Control Centre while an air raid and the operations following it are in progress. Heads of Services consult each other concerning action to be taken, and the A.R.P. Controller will be available to give any necessary major executive decisions. In the last resort, the final decision with regard to any Service would rest with the Controller, but in the ordinary way it is not intended that the latter should interfere with the operating of the services by the officers designated in charge of them under the Scheme-making Authority's arrangements. (Memorandum No. 6 pages 6 & 7).

On a scale of one per thousand of population REPORT CENTRES have as their essential functions the receiving, collecting and transmitting of information. The Report Centre collects and sifts reports of air raid damage received from wardens and others, issues
to the Services such messages as they need to arrange the despatch of A.R.P. Parties, etc. and informs the Control Centre from time to time as to the general situation.

Messages coming to the Report Centre reporting incidents are received via the "in" telephones. Each INCIDENT is given a number and "plotted" on the Report Centre MAP. By means of different coloured pins stuck into the map not only the site of the incident is indicated but also details such as the type of bomb used and the nature of the damage. Messages issued by Report Centres to Service Depots, Control Centres etc., are despatched via the "out" telephones. By means of TALLY-BOARDS indicating the number and location of individual units, the position of the Services is recorded as they are moved back and forwards. By a glance at the tally-boards it should be possible at any moment during action to see the disposition of all Service Units under the operational control of that Report Centre.

Thus, at any period during an air raid, the Report Centre Map should afford an accurate and complete picture of the situation in the local area it serves. Similarly, the Control Centre Map will represent a complete picture of the whole area of the Scheme-making Authority. The War Room Map at the
District Commissioner's Office will indicate the position in the District as a whole, and at the Regional Headquarters the Regional War Room Map that of the larger area of the Region. This is illustrated by Fig. 13.

The key service in the reporting of air raid damage is the WARDEN SERVICE. The whole of the area of the Scheme-making Authority is covered by its WARDENS' POSTS. Each Warden's Post is provided with a telephone in direct communication with the Report Centre of its area. Should telephonic communication break down messages will be sent by nearby telephones, by despatch riders, or by messengers on foot, on bicycle or in any way possible in the emergency.

In order to obtain the assistance of the A.R.P. Services of the area it is necessary to obtain contact with either Report or Control Centres. It is not possible, for example to get assistance by contacting Depots individually, A.R.P. Services being allowed to operate only under the direction of their Report Centre or Control Centre. The normal way of contacting Report or Control Centre is through the Warden. The diagram shown as FIGURE 14 illustrates the key position occupied by the Wardens in the calling out of A.R.P. Services through Report and Control Centres.
Fig. 114  SHOWING WARDENS' SERVICE
FIGURE 14.

1. Warden inspects Incident and makes out official Report for Report Centre, and proceeds to telephone to deliver his message.

2. Warden's message received at Report Centre by the "in" telephones.

3. Warden's Report from Incident plotted and directions issued to Service Units at Depots, via "out" telephones.

4. Acting on these instructions A.R.P. Units proceed to Incident.

5. Report Centre passes essential information to Control Centre.

6. Control Centre in its turn keeps District Office informed of progress of raid and thus

7. Essential details are available to Region and to Ministry.

CO-OPERATION AND CO-ORDINATION BETWEEN UNITS AND DIFFERENT A.R.P. SERVICES operating at the same incident, with the maintaining of essential contact between these Services and the Report Centre, are illustrated by the accompanying two diagrams:

Figure 15, where medical units alone are involved and Figure 16 where units of several Services are involved.
Fig. 15 SHOWING COMMUNICATION from MEDICAL UNITS CO-OPERATING AT INCIDENT to REPORT CENTRE

Fig. 16 SHOWING COMMUNICATION from DIFFERENT SERVICES CO-OPERATING AT INCIDENT to REPORT CENTRE
incident is directed by the Senior Casualty Officer or the Medical Officer if there is one present. In the absence of such Senior Officer or Medical Officer, the Leader of the first First Aid Party to arrive takes charge of the medical work at that incident, until the arrival of a doctor or Senior Casualty Officer. All first aid work at an incident is in charge of the senior casualty worker present, no matter by whom it is done.

Contact is maintained between the Casualty Services and the Report Centre through the Senior Warden present at the incident. Through this Senior Warden the services can send for such Reinforcements in men, ambulances, etc., as may be required.

FIGURE 16. At large incidents involving the combined operation of several A.R.P. Services, it is necessary to have a Senior Officer as General Manager in charge of the services and responsible for co-operation, reinforcements, contact with Report Centre, parking of vehicles, and so on. Such an officer is termed an INCIDENT OFFICER. He establishes himself at some suitable point in the vicinity of the incident. His headquarters are recognised by the Incident Officer’s Flag in daytime and coloured lights at night. He has a staff of clerks and a deputy, and
all services entering or leaving the area reports to him as they come and go. At the scene of large incidents it is very difficult indeed to maintain contact between the different services and, in fact, between units of the same service. It is the Incident Officer's responsibility to facilitate co-operation between the Senior Officers of the different services in operation, and to assist them in every possible way. It is also his duty to keep a diary of the incident noting the arrival of reinforcements, messages sent to and received from the Report Centres, and so on. At a large incident much must depend on the speed with which co-ordination of the local A.R.P. Services under the Incident Officer proceeds. Unity of control and concentration of effort are urgent early in the fight if, for example, fires are to be kept within control.

REINFORCEMENTS.

A.R.P. units proceeding as Reinforcements to a distant destination first assemble at pre-arranged rendezvous from which they proceed in convoy to one of the distant rendezvous of the area which they are to reinforce, and there they are met by local guides who direct them to their destination which may be some Depot in the area, or an actual incident.
Fig. 17  SHOWING REINFORCEMENTS WITHIN A DISTRICT
WITHIN THE DISTRICT the main links in the Reinforcement Chain are Control Centre to District Control to Control Centre. FIGURE 17 gives an example.

1. Bo'ness Report Centre sends reports of extensive damage to West Lothian Control Centre.
2. West Lothian Control Centre requests Reinforcements from Edinburgh District.
3. Edinburgh District calls on Edinburgh Control Centre for Reinforcements for Bo'ness.
4. Reinforcements from Edinburgh proceed to arranged rendezvous in West Lothian.

BETWEEN DISTRICTS the essential links in the Reinforcement Chain are Control Centre to District Control to Regional Control to District Control to Control Centre. FIGURE 18 illustrates this.

1. Dundee Control Centre requires Reinforcements from District Control, Dundee.
2. District Control, Dundee, unable to supply the required Reinforcements from within its own District, appeals to Region.
3. Region contacts another District (Edinburgh) and requests Reinforcements for Dundee.
4. Edinburgh District contacts Edinburgh Central Control and directs it to send the necessary Reinforcements to Dundee.
Fig. 18 SHOWING REINFORCEMENTS BETWEEN DISTRICTS
5. Reinforcements proceed from local rendezvous in Edinburgh to pre-arranged distant rendezvous in Dundee.

**INTER-REGIONAL REINFORCEMENTS.** In addition to the Civil Defence links in the chain of Reinforcements, liaison between the Region and the Fighting Services and the other Government Departments make available reinforcements and assistance of the widest character. A simple but sufficient illustration is afforded by the help sent to Belfast during the heavy raids experienced by that city early in 1941.

Belfast Control Centre urgently requested Reinforcements.


This Ministry in its turn contacted Scottish Region which contacted Glasgow District which instructed Glasgow Control Centre regarding Reinforcements for Belfast, and by their Naval liaison arranged for transport between Glasgow District and Belfast. These reinforcements were conveyed by destroyer to Belfast, where they were met by local guides and directed to their destination.
As already noted, the Department of Health is largely responsible as the Central Authority in Scotland for the A.R.P. Casualty Services. The Ministry of Home Security with which it shares this responsibility is mainly interested in training and operations. For the Emergency Medical Service the Department of Health is, of course, entirely responsible.

Operational control of the Casualty and other A.R.P. Services in action is through the Ministry of Home Security centres of local Control Centre, District Office and Regional Office. While the TRAINING of the Casualty Services is directed by the Training Branch of the Ministry of Home Security in London through its Regional Training Officers, the Department of Health for Scotland through its District Hospital Officers has now made provision for co-operation with the Ministry in this training. With the exception of the First Aid Parties, which still belong to the Ministry, the Department decides all matters of POLICY, ESTABLISHMENT and EQUIPMENT and authorises the EXPENDITURE of the Casualty Services throughout Scotland.
In Chapter I the main Casualty Services have been discussed. In connection with the operational control of the Casualty Services the following is a complete list of the UNITS which comprise them:

FIRST AID PARTIES, (MOBILE). These operate at the scene of the incident and are responsible for the first aid treatment and initial disposal of casualties at the scene of the incident.

FIRST AID POSTS, MOBILE. These Posts have several uses. They can open out at the actual scene of the incident, reinforce personnel and equipment at a fixed First Aid Post, take the place of a Post which has been put out of action, or form the nucleus of a temporary Casualty Clearing Hospital. In practice it is unusual now for this Unit to be called to an incident until the Medical Officer and Nurse have first visited the incident to decide if it is necessary. The Medical Officer, along with some of the Unit personnel, can often do all that is required by supervising the efforts of the First Aid Parties, giving injections of morphia, and directing the priority in initial disposal of casualties.

FIRST AID POSTS, FIXED. As already shown, Fixed Posts are capable of rendering all necessary surgical
treatment to minor surgical cases, and of cleansing such as are contaminated by liquid gas.

FIRST AID POINTS. In general these take the place of Posts in sparsely populated rural areas. A certain number of them have been upgraded to the status of small Posts at strategically important points.

CLEANSING CENTRES, FIXED AND MOBILE. The FIXED Cleansing Centres are situated in densely populated areas in the cities and are for the rapid cleansing of unwounded or very slightly wounded contaminated civilians. The MOBILE Cleansing Centre could be used for many purposes - to supplement the Fixed Cleansing Centre or the Cleansing Centre at a Post, to supply cleansing facilities in the immediate vicinity of any large gas incident or to supplement the limited facilities in rural areas. (Vide Chapter III).

CASUALTY AMBULANCES. These are mainly of two kinds, the Stretcher Ambulance with four stretchers, and the Sitting Case Car. They operate between the Units of the Casualty Service, between First Aid Parties, First Aid Posts and Casualty Clearing Hospitals.
OPERATIONAL CONTROL

Fig. 19

CONTROL OF THE CASUALTY SERVICES
CASUALTY CLEARING HOSPITALS. (Emergency Medical Service).

These Hospitals are intended for the reception of casualties either direct from the incident in the streets, or from First Aid Posts. They have all the necessary facilities, personnel and equipment, to deal with major surgical cases. It is also intended that they should have the necessary facilities for the cleansing of cases who may, in addition to their other injury, be contaminated with vesicant gas.

FIGURE 19 illustrates the Operational Control of the Casualty Services. Here the Casualty Units of the Local Scheme-making Authority are under the direction of their Control and Report Centres which in their turn are subordinate to the District and Region of the Ministry.

EMERGENCY MEDICAL SERVICE. (OPERATIONAL CONTROL).

The Headquarters of the CHIEF MEDICAL OFFICER of the Emergency Medical Service of the Department of Health for Scotland is in Edinburgh. It is important to note that his Department is in the closest possible liaison with the Headquarters (Regional Office) of the Regional Commissioner for Scotland, in Edinburgh. The Chief Medical Officer of the Department of Health in Scotland corresponds to the Regional Medical Officer of the Ministry of Health in England, except that the
Scottish Region is not under the Ministry of Health but is itself a Government Department under the Secretary of State for Scotland. There are, in addition to the Chief Medical Officer of the Region, five DISTRICT (HOSPITAL) OFFICERS corresponding to the five Civil Defence Districts.

As in Regional Headquarters so also in the Districts the closest possible liaison is maintained between the District (Hospital) Officer of the Department and the District (A.R.P.) Commissioner of the Ministry. Both are accommodated in the District Commissioner's Office, and the Hospital Officer operates with the District Commissioner from the Operational War Room of the District Office during action.

The UNITS of the Emergency Medical Service are:
- CASUALTY CLEARING HOSPITALS. (Dealt with under A.R.P. Casualty Services, Chapter I).
- MOBILE SURGICAL TEAMS. These teams, of which there are several dozen in Scotland, are composed of the necessary Specialist Staff, medical and nursing, along with equipment and instruments for the establishment of temporary and emergency operating theatres. Being mobile they can be moved from place to place as circumstances may require.
Fig. 20 SHOWING COMMUNICATIONS OF THE HOSPITAL OFFICER.

Fig. 21 SHOWING CONTROL OF E.M.S. from CASUALTY CLEARING HOSPITAL to SECRETARY OF STATE.
BASE HOSPITALS - General and Specialised.

AUXILIARY and CONVALESCENT HOSPITALS.

INTER-HOSPITAL AMBULANCES. (Motor, Train, Air and Ship).

HOSPITAL OFFICERS are assisted in the organisation and operation of the Emergency Medical Services in their districts by Surgical Directors and Specialists in Pathology, Bacteriology, Gas, Blood Transfusion Service etc.

From their station in the War Room of the District Office Hospital Officers are in direct telephonic communication with the Emergency Medical Service Hospitals and Surgical Teams of their districts. This is illustrated by FIGURE 20.

In FIGURE 21 is shown the operational control of the Emergency Medical Service from the time when casualties reach its Casualty Clearing Hospital and until these have been finally disposed of. The A.R.P. Casualty Service delivers the Casualty to the Casualty Clearing Hospital of the Emergency Medical Service, the Operational and Administrative Control of which proceeds via the Hospital Officer and Chief Medical Officer of the Department of Health for Scotland.
Fig. 22  SHOWING LIAISON BETWEEN DEPARTMENT AND MINISTRY IN THE REGIONAL AND DISTRICT CONTROL OF THE EMERGENCY MEDICAL SERVICE AND THE CASUALTY SERVICE.
FIGURE 22 illustrates in diagrammatic form the close and significant LIATION obtaining between the Regional Commissioner of the Ministry and the Chief Medical Officer of the Department, on the one hand; and the District Commissioner of the Ministry and the District (Hospital) Officer of the Department, on the other hand, in the Regional and District Control respectively of the Casualty and Emergency Medical Services.

GAS DETECTION AND IDENTIFICATION SERVICE.

We now go on to discuss the special arrangements which have been made for the identification of the war gases and for the diagnosis and treatment of gas casualties. The MINISTRY OF HOME SECURITY Gas Detection and Identification Service is responsible for chemical investigation, and the DEPARTMENT OF HEALTH Mobile Gas Team and District Gas Specialists are responsible for medical investigation.

HOME OFFICE GAS DETECTION AND IDENTIFICATION SERVICE.

There are two Sections in this Service, all of whose members are specialists. The LOCAL SECTION under the corresponding Scheme-making Authority consists of Gas Identification Officers, and the REGIONAL SECTION, under the Ministry, consists of the Regional (Senior) Gas Adviser and the District
(Junior) Gas Advisers.

THE LOCAL SECTION. The GAS IDENTIFICATION OFFICERS who form part of the A.R.P. Organisation of the local Scheme-making Authority act in an advisory capacity as professional Gas Identification Consultants. They are all persons of suitable professional qualifications who have also received special Air Raid Precautions training. In the larger cities the local Gas Identification Services are directed by a SENIOR GAS IDENTIFICATION OFFICER, as in Edinburgh whose well organised Local Gas Identification Service is under the direction of a distinguished pioneer in Gas Warfare, Colonel P. S. Lelean, C.B., C.M.G., Professor of Public Health of Edinburgh University. It is not intended to embark here on a discussion of the training equipment and functions of this Service throughout Scotland. In passing, however, it may be remarked that there is considerable criticism, with which the writer has much sympathy, concerning the adequacy of the specialised training given to Gas Identification Officers. Gas Identification Officers are supplied with protective clothing, steel helmets painted yellow and general service respirators. They carry chemical equipment for the detection of certain of the war gases.
In the event of gas being used against the civilian population it will become the duty of the Warden who furnishes the initial report to Report Centre to indicate the presence of gas. Having received this initial report that gas has been suspected the Report Centre directs a Gas Identification Officer of the Local Service to proceed to the Incident in order that the gas may be detected and identified. Gas Identification Officers report to Control Centres. At these Centres reports reach Controller, thus becoming available to the Senior Local Gas Identification Officer, Gas Advisers and Medical Officer of Health.

THE REGIONAL SECTION. The Ministry of Home Security REGIONAL GAS ADVISER for Scotland is situated in Glasgow. DISTRICT GAS ADVISERS are situated in Edinburgh, Dundee and Aberdeen and their respective districts correspond to the Civil Defence Districts. The Regional Gas Adviser acts in addition as District Adviser of the Glasgow and Inverness districts. All Gas Identification Officers' Reports in their Districts are automatically passed to the District Gas Adviser in the routine of communications. In the event of the non-identification of a gas by local Gas Identification Officers the services of the District Gas Adviser are immediately required for the
Chemical Investigation of samples, and in an advisory capacity in consultation with Civil Defence Authorities, with the Local Gas Identification Officers and other Civil Defence officials of the area. The Regional Gas Adviser maintains close liaison with the District Gas Advisers and he is available at any time for consultation. The laboratory facilities available to the Regional Gas Adviser are superior to those possessed by District Gas Advisers and, therefore, to the former all problems of identification should be referred without delay.

DEPARTMENT OF HEALTH MEDICAL GAS SPECIALISTS.

The Department of Health has appointed MEDICAL GAS SPECIALISTS in each of the five Districts in Scotland. These Medical Specialists will be available to advise hospitals in their District in the diagnosis and treatment of gas casualties. In order to facilitate diagnosis, instructions have been issued to hospitals by Hospital Officers regarding the collecting and forwarding of post-mortem specimens for examination (see Appendix II on "Suggestions for P-M. Material"). Some thirty-five doctors from the main hospitals throughout Scotland have been trained as Medical Anti-Gas Instructors. These will act as Gas Specialists in the Institutions in which they operate. There is in addition, in Glasgow, a MOBILE MEDICAL GAS TEAM of
Clinical Gas Specialists working in close liaison with the Regional Gas Adviser. This Clinical Team is available to proceed to any part of the country at any time.

CORRELATION OF MEDICAL AND CHEMICAL DATA: FOUR LEVELS.

In the event of gas being used either alone or in conjunction with high-explosive and incendiary bomb, the first contact with gas casualties will inevitably be at the scene of the incident. The medical personnel sent to succour these victims will be, as we have seen, the First Aid Parties. The initial problem of the diagnosis and first aid treatment of gas casualties may, therefore, fall on the least highly trained of our medical services. - The initial chemical detection and identification of the gas will fall on the comparatively untrained Warden until the arrival of the Gas Identification Officer. It is, therefore, of the highest importance, particularly in the initial gas attacks, that these A.R.P. personnel should fully appreciate the value of the proper correlation of the physiological and chemical data available on the spot at this early stage. The First Aid Parties, Wardens and the Gas Identification Officer must co-operate at the Gas Incident in the identification of the gas and diagnosis of the casualty. The physical character and
signs and physiological action of all the common gases will be sufficiently characteristic to make reasonably possible rapid identification and diagnosis by these personnel if their training has been carefully enough supervised. We may call this correlation at the incident the First or LOCAL LEVEL.

Should the Casualty Services at the incident be unable to diagnose the gas casualties, these will be disposed of to First Aid Posts and Hospitals. Medical reports on such cases will reach the Hospital Officer without delay. As Hospital Officer of the District he will be in communication with all Hospitals that have admitted gas casualties. Reports reaching Control Centre from Gas Identification Officers to the effect that identification has not been possible at the incident, together with samples collected and forwarded by the Gas Identification Officer along with his official report, should pass without delay to the District Gas Adviser. This last in his capacity as the Senior Gas Specialist of the District will be in direct touch with Local Gas Identification Officers of all areas in which gas has been used. At this stage correlation between the clinical, pathological, bacteriological and chemical data available to the corresponding District Medical and Gas Specialists constitutes the Second or DISTRICT LEVEL in the
CORRELATION OF MEDICAL AND CHEMICAL DATA.

GAS INCIDENT.

1. Scheme-making Authority (Casualty (A.R.P. (Units. Gas Identification Service ) Scheme-making Authority.) Correlation at the LOCAL level of physiological, clinical and chemical data by local Scheme-making Authority.

2. Department of Health (District (Hospital (Officer. District) Gas Adviser. ) Correlation at DISTRICT level. Ministry of Home Security (Liaison with Fighting Services).)

3. Department of Health (Regional (Clinical (Gas Team. Regional) Gas Adviser. ) Correlation at REGION level. Porton Experimental Station (NATIONAL level).)

Fig. 23.
identification of the gas and the diagnosis of the gas casualties.

In the event of some new gas being used by the enemy of which the detection and identification could not be immediately decided by the District Medical and Gas Officials concerned, all available data would be submitted via the appropriate channels to the Senior Gas Adviser for the Region and the members of the Clinical Mobile Gas Team. This third level represents the full Medical and Chemical resources of the Region and may be called the REGIONAL LEVEL.

In the case of failure at the third level, and this eventuality must be foreseen, steps would be taken without delay to make all necessary samples, reports and materials available to the Government Experts in the Chemical Research Station at Porton. This forms the Fourth or NATIONAL LEVEL.

FIGURE 23 demonstrates by a simple diagram the four levels of correlation described. It will also be noted from this Figure that LIAISON WITH THE THREE FIGHTING SERVICES is maintained by both the Ministry of Home Security and the Department of Health for Scotland in order that there may be the necessary co-operation and co-ordination in the Gas Identification
Services of both Civil and Fighting Organisations.

From the foregoing very brief and simple description of Organisation and Operation of Control of the Civil Defence Services, it will be at once appreciated that the main responsibility in the early (diagnosis and in the preventive and first aid treatment of the gas casualty falls upon the personnel of three units in our Civil Defence Medical Services: the First Aid Party, the First Aid Post and the Casualty Clearing Hospital. In subsequent chapters will be considered the gases which these personnel are likely to meet with as the causal agents, their anti-gas training and equipment, and the official anti-gas and first aid preventive treatment set down for their guidance.
CHAPTER III

THE WAR GASES IN CIVIL DEFENCE
**Fig. 24.**

**OUTLINE TABLE OF WAR GASES.**

<table>
<thead>
<tr>
<th>Eye Irritants</th>
<th>K.S.K.</th>
<th>Liquid</th>
<th>Persistent</th>
<th>Harassing.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nose &quot;</td>
<td>B.B.C.</td>
<td>Solid</td>
<td>Non Persistent</td>
<td>Non Persistente</td>
</tr>
<tr>
<td>Lung &quot;</td>
<td>D.M., D.A., D.C.</td>
<td>True Gas</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Non-Blister.</td>
<td>Phosgene</td>
<td>True Gas</td>
<td>&quot;</td>
<td></td>
</tr>
<tr>
<td>Hemolytic Gas</td>
<td>Chlorine</td>
<td>True Gas</td>
<td>&quot;</td>
<td>Lethal.</td>
</tr>
<tr>
<td>Paralysant Gas</td>
<td>Arsine</td>
<td>True Gas</td>
<td>&quot;</td>
<td>Producing</td>
</tr>
<tr>
<td>Lewisite</td>
<td>HCN</td>
<td>True Gas</td>
<td>&quot;</td>
<td>Bodily</td>
</tr>
<tr>
<td>Mustard</td>
<td>Lewisite</td>
<td>Persistent</td>
<td>&quot;</td>
<td>Disablement.</td>
</tr>
</tbody>
</table>

K.S.K. Ethyl Iodoacetate.
B.B.C. Bromobenzyl cyanide.
D.M. Diphenylamine chlorarsine.
D.A. Diphenyl chlorarsine.
D.C. Diphenyl cyanarsine.

ARSINE. Arseniuretted hydrogen.
H CN. Hydrocyanic acid.
LEWISITE. Chlorovényl dichlorarsine.
MUSTARD. Dichlorodiethyl sulphide.
CHAPTER III.

THE WAR GASES.

By the term WAR GASES is meant any chemical substance solid, liquid or true gas, used in warfare for its harmful effects on the body.

The OUTLINE TABLE given on the opposite page includes representatives of all the more important war gases and contains essential data in outline.

The principal gases used by the Germans IN THE GREAT WAR (1914-18) were Mustard (Yellow-Cross), Phosgene (Green-Cross) and the Nasal Irritants (Blue-Cross). Of the Shell Gas casualties produced by these gases during 1917-18, 30% were due to Mustard, 10% to Phosgene and 10% to Nasal Irritants. The methods employed by the Germans in their gas attacks were mainly the Gas Cloud, the Gas Projector and the Gas Shell, the last method greatly predominating. Gas Warfare in the last war was limited to the actual combat area and the resulting casualties were almost entirely limited to the personnel of the Fighting Services.

In considering the possibility of gas attack on civilian population it is officially taught in the Home Office Gas Schools that the GASES LIKELY TO BE
EMPLOYED BY THE ENEMY are of three types:

**Non-Persistent Gases** like Phosgene, which are very dangerous in built-up areas but less so in open spaces.

**Vesicant Liquids** like Mustard Gas, which are effective in both liquid and vapour form and contaminate the area in which they fall, and

**Mask Breakers** (so-called) such as the Arsenical Smokes and Tear Gases which are harmful only when gas discipline is bad.

New Gases are said to be highly improbable.

The possible METHODS OF GAS ATTACK likely to be used against civil populations are stated to be three: Bombs, Low Spray and High Spray. Any other methods, powders for example, are said to be most unlikely. Bombs are still considered in the forefront in importance.

**Low Spray** is officially defined as Mustard Gas sprayed from as low as 300 ft. The only antidote is to take cover.

**High Spray** is defined as spray delivered from normal flying height by at most a few planes and of a nuisance, rather than a casualty-producing, value.

The POSSIBLE OBJECTIVES in enemy gas attack might be to produce panic and gas casualties in large centres
of population, to knock out central points of communication, to hold up work at important sea-ports by heavy contamination, or to follow on high-explosive and incendiary attack on cities.

This Chapter will be devoted to an examination of examples of each of the three more important types of War Gases in the following order: Mustard Gas and Lewisite (Blister), Phosgene (Lethal), and Nasal Irritants (Harassing). Each of these four gases will be discussed under Chemical and Physical Properties, Physiological Action, Symptoms, Treatment, Assessment of Attack, and Preventive and First Aid Measures by First Aid Parties, by First Aid Posts and by Casualty Clearing Hospitals.

TYPE: BLISTER, PERSISTENT MUSTARD GAS.

"Mustard" Gas has no chemical similarity to the natural mustard oils. Its characteristic mustard odour was at once recognised by the British Tommy when he first came up against it in France in the Great War, hence its name Mustard. The French called it Yperite because it was first used against them in Ypres. The use of the name Yellow-Cross, by which it is frequently described, is due to the German Mustard Gas shells being distinguished by a yellow cross. Its code letters H.S. are a contraction for Hunstoff.
H.S. was the vesicant gas of the 1914-18 War and by far the most effective chemical agent employed by the Germans. During the "Lethal" (Phosgene) Gas Shell period, July 1916 - July 1917, there were in all 3,806 Gas Shell casualties with an average mortality of 6.0%. But, during the Mustard Gas period, July 1917 to the end of the War, the total Gas Shell casualties rose to 161,000 with an average mortality of 2.6%.

Mustard Gas, Dichloro-diethyl-sulphide has the chemical formula \( \text{CH}_2\text{Cl. CH}_2\text{S} \). In the crude state it is a dark brown, oily liquid. Pure mustard gas is a clear, colourless, heavy oily liquid. The crude form was employed in France and by the Italians in Libya. It has also been employed by the Japanese in China and quantities have been discovered hidden in certain parts of Greece.

**CHEMICAL AND PHYSICAL PROPERTIES.**

Under suitable atmospheric and climatic conditions Mustard Gas can persist in the open for as long as one week. Such "surface" persistence could be expected to last for several days in this country. Liquid Mustard which has been covered up by, for example, debris from a shattered building, could persist for a much longer period. Its "under-surface" persistence
has an important bearing on the work of our Rescue Parties.

Both physically and chemically Mustard Gas is a stable substance. It is only very slowly hydrolysed by water, the products of its decomposition (hydrochloric acid and thiodiglycol) being practically harmless. For its chemical neutralisation strong reagents are required such as strong nitric acid or other strong oxidising agents. In Civil Defence four main methods are employed for its destruction: oxidisation by burning, hydrolysis by steam or boiling water, chlorination by bleaching powder, and "weathering". In burning or boiling mustard contaminated articles, both the fumes from the fire and the steam from the water contain poisonous amounts of hot live Mustard vapour, so it is essential that great care be taken in employing these methods where there is any possibility of the vapour reaching dwelling-houses, workshops or other buildings. In chlorination advantage is taken of the action of Chlorine on Mustard Gas. Tropical Bleach Powder contains about 32% of Chlorine. The Weathering Process i.e., the action of the sun, rain and wind, act partly by evaporation and partly by hydrolysis. This last is a method which, owing to its protracted character, should only be employed with such articles as cannot be
treated by the other more rapid and efficient methods.

Mustard Gas is soluble in all fuel and lubricating oils. It is also soluble in alcohol, ether, petrol, paraffin and in many other organic solvents. Both the liquid and the vapour are very readily soluble in all animal fats. Owing to this lipoid solubility Mustard Gas quickly and thoroughly penetrates the layers of the skin. In penetrating the skin it extends downwards and outwards in all directions, so that a drop about the size of a pin head can produce a blister about the size of a threepenny piece.

Mustard Gas has a very marked power of penetration into almost every kind of article of a porous or semi-porous character. Its penetration is, however, resisted by metals, glass and highly-glazed objects. From this it will be appreciated that it penetrates clothing which can be only a very temporary protection. Owing to the letter issued by the Department of Health for Scotland to Medical Officers of Health (referred to in Chapter II and known unofficially as the "Striptease Circular"), alleging the deadly rapidity and gravity of Mustard Gas contamination, necessitating immediate removal of all clothing, the following EXPERIMENT was carried out as a test during one of the writer's visits to the
Experimental Station at Porton. Three circular pieces of serge material, one layer thick, each about the size of a penny, were attached by means of elastic bands to three areas of the forearm. The material was thus kept in close contact with the skin surface. On each of these pieces of serge, one 2 mm. diameter drop of liquid mustard gas was placed. The first serge was removed in five minutes, the second in ten and the third in fifteen. After removal the under-surfaces of the three pieces of material gave negative results to tests for liquid mustard gas. Twenty-four hours later the forearm was examined. The area exposed for five minutes was undamaged, that exposed for ten minutes showed moderate erythema and the third area was slightly blistered. This demonstrated two things: first, that it required from five to ten minutes for the drop of liquid mustard gas to cause sufficient penetration through one layer of clothing in intimate contact with the body surface to produce even slight erythema, and second, that at the end of fifteen minutes vapour only and not liquid had penetrated. The Porton experiment thus disproved the idea that Mustard Gas passes through clothing instantaneously and that the Mustard Gas blister is dangerous to life.

The freezing point of crude Mustard Gas is about
6° C. and that of pure Mustard Gas 14.1° C. These comparatively high freezing points limit the usefulness of the gas in cold weather, but Frozen Mustard Gas can be a source of considerable danger if carried about on boots and clothing and thus brought into houses and workshops by unsuspecting victims.

The odour is like mustard or garlic. It is weak and could easily be masked by other stronger smells. The sense of smell quickly tires: to one who has been in a Mustard Gas atmosphere for some minutes the odour may seem to have disappeared. There is a chemical detector, a yellowish paint which turns red on contact with the Liquid, but this does not detect the presence of the Vapour. The training of A.R.P. personnel in recognition of the odour of Mustard Gas Vapour is, therefore, highly important but it is also essential to emphasise that, though present, it may not be possible to detect its distinctive odour in the presence of other stronger smells. It is a safe guide to hold that, if there is enough Mustard Gas to smell, there is enough to be dangerous and to necessitate immediate precautionary action.

The persistence, stability, solubility and power of penetration of Mustard Gas combine to complicate
the problem of the Casualty Services both in the
treatment of the Mustard Gas casualty and the
protection of its own personnel.

PHYSIOLOGICAL ACTION.

Mustard Gas "damages in two ways": by the
action of the Liquid and by exposure to the Vapour
in the atmosphere. Liquid mustard gas reaching the
skin produces no more immediate irritation than would
a drop of water. With exposure to mustard gas vapour
there is no immediate irritation of eyes, lungs or
skin. The victim may, therefore, be quite unaware
of contamination by mustard gas, liquid or vapour.
There is, however, one notable exception to this rule
of insidiousness. Should the eye receive a drop of
liquid mustard gas some immediate irritation will
usually be produced. This initial irritation quickly
subsides and there may be an entire absence of any
discomfort until the later evidences of pain and
swelling make their appearance.

The initial erythema resulting from liquid mustard
gas burns of the skin makes its appearance in two hours.
The eye injured by liquid mustard gas will be closed
with oedema and swelling and out of action within an
hour. Characteristic symptoms of vapour burning of
the skin and eyes and lungs make their appearance
after a delay of about six hours. Delay in this case depends on two factors: the strength of the concentration to which exposed, and the length of time exposed to it.

While the respirator does afford complete protection to those parts which it covers - the eyes, the skin of the face and also to the lungs - additional protection is required for the skin of the body by some form of protective clothing. This is demonstrated in the PHOTOGRAPH opposite (taken from the Home Office "Atlas of Gas Poisoning") showing the blistering effects of mustard gas on the buttocks of a soldier who, in a gas attack, put on his respirator but sat down on a stone contaminated by liquid mustard gas. His respirator had not been a complete protection!

Other gases have a selective action on the body, the eye and nose irritants, for example, selecting the exposed sensory nerve endings and mucous membranes of the eye, nose, throat etc. Mustard gas, on the other hand, has a universal action. It exercises its characteristic vesicant effects on any part of the body with which it comes into contact.

While its action is universal it is also local. That is, it exercises its characteristic effects only
on those parts of the body with which it actually comes into contact.

Mustard gas vapour builds itself up in the body. The longer the exposure the greater will be the resulting damage to tissue because of the increased amount absorbed. Thus a concentration which might be harmless for a ten minute exposure might produce after an hour's exposure serious symptoms of poisoning. One of the least appreciated and yet most subtle dangers to personnel working in areas contaminated by mustard gas is this cumulative action of the gas. It is specially to be guarded against where there are pockets of mustard gas contamination or in ill-ventilated rooms of Cleansing Centres where personnel may be on duty for long periods. Medical Officers responsible for medical staffs and personnel require to be constantly on the alert under such conditions.

All persons who have not been previously exposed to the effects of the gas possess more or less the same degree of sensitivity, but persons who have been exposed earlier may become hypersensitive to them.

To sum up, because of the marked insidiousness and delayed action of the gas, Mustard Gas casualties may not be recognised until it is too late to apply
preventive treatment. Casualties suffering from temporary blindness, inflammation of the throat and possibly bronchitis, and with blistered skins, will require a considerable amount of medical treatment. The nursing of large numbers of mustard gas casualties could be a very serious proposition. In order better to appreciate the problem presented to the Civil Defence Casualty Services by contamination with this gas, we shall now survey briefly Symptoms and Treatment.

**SYMPTOMS.**

<table>
<thead>
<tr>
<th></th>
<th>Liquid.</th>
<th>Vapour.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eye</td>
<td>Immediate</td>
<td>6 hours' delay</td>
</tr>
<tr>
<td>Skin</td>
<td>2 hours' delay</td>
<td>Lungs 6 hours' delay</td>
</tr>
<tr>
<td>Stomach &amp;</td>
<td></td>
<td>Skin 6 + + hrs. delay</td>
</tr>
<tr>
<td>Intestines</td>
<td>2 hours' delay</td>
<td>Stomach Early.</td>
</tr>
</tbody>
</table>

**EYES.** (Liquid and Vapour Contamination).

Recent research work carried out at Porton and Edinburgh in conjunction with experience gained in the treatment of casualties in gas factories in this country has modified the teaching with regard to mustard gas lesions of the eye. The present clinical picture as regards symptoms can be summarised as follows:

Nature of Lesion:

1. Primary Stage of Acute Involvement.
1. **MILD CASE.**

Illustrates conjunctival injection in a "mild case" although lids would show some redness of the margins and vessels would not be so clearly outlined as in the above illustration (Scott).

2. **SEVERE CASE.**

Illustrating appearance of Cornea in a severe case. (Scott).

From ATLAS OF GAS POISONING.
2. Secondary Stage of Delayed Vascularised Keratitis, which only develops in small percentage of more severe cases.

Mild Lesions: after short exposure to dilute vapour. Symptoms commence in from 5 to 1/3 hours - prognosis good - clears up in from 7 to 1 1/4 days - no complications.

Moderately Severe Lesions: after longer exposure to vapour - onset delayed 5 to 8 hours - considerable pain - intense blepharospasm - lids oedematous - conjunctiva very congested especially in palpebral aperture area - cornea dull and lustreless owing to oedema - gradual recovery in 3 to 5 weeks - Complications: functional photophobia, secondary infection and delayed keratitis.

Severe Lesions: after longer exposure to very concentrated vapour, or droplet or liquid splash - symptoms delayed 1 to 5 hours - pain intense - bulbar-conjunctiva exposed in palpebral aperture is pale - conjunctiva covered by lids very congested and oedematous - cornea very hazy - desquamation of epithelium - complications: secondary infection, delayed keratitis, functional photophobia - Prognosis: majority fit for duty three to four months.

LIQUID BURNS OF THE SKIN.

The typical mustard gas blister shows three definite zones of blister, oedema and erythema. This is clearly
Typical Mustard blister showing
Blister,
Zone of oedema,
Surrounding erythema.

Photo C.
shown in PHOTOGRAPH A on the opposite page. More severe burning produces a blister which is likely to be much less characteristic as is seen in PHOTOGRAPH B. By contrast PHOTOGRAPH C illustrates a typical Lewisite blister. (Page 126).

STOMACH AND INTESTINES. (Liquid Contamination).
Drops of liquid mustard gas splashed into the mouth and swallowed with the saliva may produce the typical blister formation and resulting ulceration in the stomach and intestines.

VAPOUR BURNS OF RESPIRATORY ORGANS.
Almost simultaneous with the onset of conjunctivitis the toxic effects of mustard gas vapour on the respiratory tract are evidenced by an early rhinitis, sneezing and the discharge of a profuse watery secretion, soon to become muco-purulent. The larynx is affected early, hoarseness and aphonia are frequent. In severe cases the laryngeal inflammation may be reproduced in the trachea and even in the bronchi. The dry, irritating cough produced by the initial laryngitis gives place to a loose cough and profuse muco-purulent sputum and sternal pain. Rising temperature and pulse indicate the onset of septic bronchitis and may lead to broncho-pneumonia with cyanosis. But in the majority of cases the lesion is
Microscopic Section of Lung from Mustard Poisoning.

Microscopic Section of Lung from Phosgene Poisoning.

From ATLAS OF GAS POISONING.
confined to a bronchitis which clears up in the course of a month or six weeks leaving no after effects. The train of symptoms resulting from severe vapour damage to the respiratory tract illustrates its devitalising action on tissue, with the secondary septic infection which so often complicates the initial lesion. This is a potent factor in delaying the satisfactory healing of these burns. The majority of deaths from mustard gas in the last war were due to secondary infections of the respiratory tract. As illustrated in the accompanying PHOTOGRAPHS this is in marked contrast to fatal poisoning by Phosgene with pulmonary oedema as the essential pathological feature.

VAPOUR BURNS OF THE SKIN.
Mustard gas vapour shows a particular affinity for the hot moist areas of the body, especially the genital and perineal area which may be as severely affected as the exposed areas of the face, neck, hands and wrists. After delay of from 2 to 4½ hours an erythematous blush appears over the infected area and gradually deepens in intensity until the skin looks scorched.

ALIMENTARY TRACT. (Vapour Contamination).
Saliva or nasal secretion impregnated with mustard gas vapour and swallowed may be the cause of early nausea
or vomiting, accompanied by epigastric pain which often as an early symptom occurs in cases of mustard gas poisoning.

An observation of significant tactical importance, to be made from a study of the symptoms of mustard gas poisoning, is that this gas is not a "killer" as, for example, Phosgene or Chlorine. In the last war only some 2% of mustard gas cases were fatal, but there was ample evidence of the value of mustard gas as a casualty producer - its great effectiveness in producing large numbers of victims suffering from injuries to eyes, respiratory tract and skin, thus incapacitating large numbers of personnel, and the consequent heavy strain on the Medical Organisation from sudden waves of admissions. The fact should be appreciated that it could also be employed in cities against a civilian population with devastating effect.

TREATMENT.

THREE METHODS.

1. By Bleach
   (Tropical Bleach Powder)
   (Bleach Ointment No.1)
   (Bleach Cream)
   (Protective Ointment No.2)

2. By Solvents
   Paraffin, Alcohol, Petrol

3. The Washing Process
   (As in Cleansing Centres of
   (First Aid Posts etc.)
Contamination 1.1 mm. diameter drop of mustard gas placed on the bare skin. The time shown is the interval between contamination and the commencement of treatment.

Photographs taken the following day.
TREATMENT BY BLEACH.

Bleach Ointment No. 1 is a mixture of equal parts of tropical bleach and white petroleum jelly. It contains some 15% of Chlorine. It is used on contaminated areas of the skin. Its effective application requires that it should be applied within five to ten minutes of contamination and rubbed well into the affected area for one minute. As it is itself irritating to the skin it should be completely removed after one minute.

Bleach Cream is a mixture of tropical bleach and water. For skin application a cream sufficiently thick to enable its rapid application to the skin surface by means of a large brush is obtained by mixing one part of bleach with two to three of water. The cream should be washed off thoroughly after one to two minutes' application. After treatment with either the ointment or the cream it is advisable to wash the area thoroughly with soap and water. The accompanying FIGURES illustrate 1. the value of early application, before 10 minutes, of bleach ointment in liquid mustard gas contamination of the skin and 2. the efficacy of bleach treatment even in the hands of the untrained person. (Photographs on pp. 97 and 99).

Protective Ointment No. 2 contains about 25% of Chloramine-T in a vanishing cream with a watery base. In effectiveness it is the equal of bleach ointment.
A. Shows gross contamination of skin with mustard gas. Treatment was by anti-gas ointment applied by unskilled man in accordance with instruction.

B. Taken next day shows the value of this treatment in preventing severe injury.
It is applied and rubbed thoroughly into the skin until it vanishes, and it should not be removed. It is now being issued in place of No. 1 Ointment to the A.R.P. Services and is on sale to the Public. It may be applied to contaminated skin at any time after contamination has taken place provided erythema has not yet developed. The use of Bleach, on the other hand, should be limited to the first ten minutes following contamination, even although erythema has not yet appeared. The advantages of Protective Ointment No. 2 over Bleach Ointment No. 1 are that it does not irritate the skin, that it can be applied without harm any time before erythema appears and that it is also useful in Lewisite poisoning.

TREATMENT BY THE SOLVENTS - Paraffin, Petrol, Alcohol etc. While the above ointments and cream act by destroying the mustard gas poison, the solvents act by removing it, a process of dilution. Rags soaked in the solvent are used to swab the contaminated skin areas. By the use of several such swabs, and repeated and careful swabbing, all the liquid mustard gas can be removed from the layers of the skin, always provided that the treatment has been applied in time, that is within five to ten minutes.

TREATMENT BY THE WASHING PROCESS. In this method
the patient is first stripped of his contaminated clothing and then given a bath with warm water and soap. Details of this process will be discussed at some length in dealing with the procedures carried out in the Cleansing Sections of First Aid Posts and Casualty Clearing Hospitals.

TREATMENT OF MUSTARD GAS EYE LESIONS.
The methods described above are, of course, inapplicable to the eye. The present teaching in regard to the treatment of eyes contaminated by mustard gas is the result of Porton research work, to which reference has already been made. It has been summarised by one of the research workers under two headings, Preventive and Curative Treatment.

Preventive Treatment. 1. The wearing of respirators and keeping under cover. 2. The immediate washing out of the eye with water. It is pointed out that the effect of liquid contamination of the eye may be lessened if the eyes are immediately flushed out with water. This urgent preventive treatment, to have any chance of being effective, must be applied within two to three minutes.

Curative Treatment. 1. Immediate first aid irrigation has already been noted. It is good to open the lids if they are closed by blepharospasm, in order that the casualty may realise that he is not blind. Instil a
few drops of 2.5% albuclid soluble. Never instil cocaine, bandage or cover eyes, or instil oily drops or carry out repeated irrigation as a first aid measure. 2. Hospital. The case should be seen as early as possible by an Ophthalmic Specialist.

**ASSESSMENT OF MUSTARD GAS ATTACK.**

**ATTACK BY BOMBS.**

Bombs falling in a Street.

If a blister gas bomb of 50 kilo. weight falls in a street the result will be a lesser area of heavy contamination and a larger area, mostly downwind, of droplet contamination. The zone of heavy contamination, of some twelve yards' diameter and covering about 120 square yards, will give off vapour and be highly dangerous until decontaminated. The area of droplet contamination, extending downwind to a distance of about one hundred yards, will be safe after one day's weathering. Where there is a crosswind the contaminated area may involve side-streets.

In the event of contamination of the limited extent detailed above, it would be necessary to evacuate all houses within 35 yards of the crater, and the inhabitants should be instructed to leave through the back entrances, having first closed all doors and windows at the front of the house if these
are still undamaged. Though the inhabitants in the houses for the next 65 yards do not require to be evacuated they should be warned to seal up the front of their houses, to remain as far as possible in the back rooms and to enter and leave by the back. It may be necessary to evacuate any houses in this section with damaged windows or doors. In the case of heavy contamination of a house owing to its proximity to the bursting bomb it may have to be evacuated for a considerable period. As a general rule it will be possible to open up all the houses and air them as thoroughly as possible immediately decontamination has been effected, after which it would be safe to allow the inhabitants to regain occupation.

All persons caught out-of-doors within the areas of heavy and light contamination will be splashed to a greater or a lesser degree with the liquid. Unless they are wearing respirators and protective clothing, as, for example, Civil Defence personnel, they will also be contaminated by the vapour. The inhabitants of nearby houses whose doors and windows are closed should escape contamination. But if doors and windows have been destroyed, either by the action of the gas bomb itself or, as is possible, by high explosive bombs dropped earlier in the raid, mustard
gas vapour and, to a lesser extent, the liquid will gain entrance to houses and result in casualties among the occupants.

Bombs falling on Houses.

When a blister gas bomb penetrates a house and contaminates the inside, all the occupants of that house must evacuate it instantly. The decontamination of such a house may be a very complicated task taking some days or weeks, depending on how soon it can be attended to. Whether or not it will be necessary to close the road will depend on circumstances. It may be necessary to evacuate the adjoining houses, and pedestrians should be warned not to delay in walking past the house. It is not thought likely that the houses on the other side of the street would require to be evacuated.

Bombs falling in Open Spaces.

When the bomb-burst is some distance from houses or roads the problem is less urgent. If it is decided to fill in the crater and depend on the action of weathering it will be necessary to warn the public by notices placed round the area, or in some other way, that the area is dangerous because of blister gas.

When the bomb-burst is near houses or public thorough-fares, in addition to filling in the crater the treating
of contaminated surfaces with bleaching powder is essential. Such areas, in close proximity to houses and thoroughfares, must be roped off and suitably marked.

**ATTACK BY SPRAY.**

Blister gas may be carried by aircraft in containers and released in the form of liquid spray by day or by night. The liquid falls to the ground in many drops of varying sizes. Being heavier the larger drops, will fall to the ground nearer to the path of the aircraft than the smaller drops which are carried further downwind. The spray is usually invisible except when released at low heights, when the liquid can be seen leaving the container. The average rate of fall is about 1,000 feet to a minute. Therefore at high altitudes there will be considerable delay between the release of the spray and its arrival on the ground.

Mustard gas is the most suitable vesicant gas for spraying, as it is not greatly affected by atmospheric conditions.

**SPRAY FROM A HEIGHT OF 10,000 FEET** suggests the following considerations.
The area covered by high spray is large. One aeroplane may spray effectively an area of several square miles, and within it all persons who do not take protective measures may become casualties. Further downwind there will be a larger area where the spray will fall in very small drops, and in which persons may not be affected unless drops enter their eyes or fall on exposed parts of their bodies.

According to their type aircraft can carry varying quantities of gas in two or three separate tanks. The capacity of the largest may be of the order of 3,000 lbs.

The duration of emission may be as long as a minute and the length of a rod of emission may be 6,000 yards. This rod of liquid will break up into drops of varying sizes, the largest being 5 mms. in diameter and the smallest less than 0.5 mm. These drops will come under the influence of any wind and whereas the largest drops will fall fairly steeply, the smaller drops will be blown a considerable distance away. The time of fall of the drops also depends on their size and the largest will fall seven times as quickly as the smallest.

Assuming the most unfavourable case in which the
aircraft flies across the wind, the spray descends over a parallelogram about 6,000 by 5,000 yards. This consists of drops decreasing in size falling in zones increasing in breadth. A person standing still or walking a few yards will be in one zone only and will largely receive drops of one size only. The number of drops falling on him is inversely proportional to the height of release and the wind velocity. For 10,000 feet and a 10 mi./hr. it is assessed that under the worst circumstances the number of drops in the various zones would be:

<table>
<thead>
<tr>
<th>Diameter</th>
<th>Drops</th>
<th>Diameter</th>
<th>Drops</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.5-1.0 mm.</td>
<td>80</td>
<td>2.5-3.0 mm.</td>
<td>12.0</td>
</tr>
<tr>
<td>1.0-1.5 mm.</td>
<td>57</td>
<td>3.0-3.5 mm.</td>
<td>2.9</td>
</tr>
<tr>
<td>1.5-2.0 mm.</td>
<td>28.5</td>
<td>3.5-4 mm.</td>
<td>2</td>
</tr>
<tr>
<td>2.0-2.5 mm.</td>
<td>21.5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

A person might get 80 small drops or 2 larger ones according to his position. Opinion in regard to the casualty-producing value of aeroplane spray has been expressed thus by Porton authorities: In the season when overcoats are not worn 10 drops of vesicant on a man, the diameter of the drops being not less than 1.5 mm. in diameter, will cause him to be a casualty. When overcoats are worn the relevant effort required is some 250 drops per man, of diameter not
less than 2 mm. It will be appreciated that the nature of the clothing, its thickness, and the surface area of skin exposed to aeroplane spray, must be the main factors in assessing the casualty-producing value of any degree of contamination.

Thus High Spray from aeroplanes, unless a mass attack is made, has obviously a nuisance, rather than a casualty-producing, value. The spray will fall long after the planes are past and without warning. Its duration will be very brief and the majority of people will not detect it.

LOW SPRAY would appear to be possible only in the open and is, therefore, not considered a method which could be used successfully in built-up areas against a civilian population.

From the above assessment it would appear that the gas bomb would be the only effective method of using vesicant gas against cities. In considering methods for the protection of the civilian population and for the preventive and first aid treatment of casualties it will be assumed here that the mode of attack will be the gas bomb.
PREVENTIVE AND FIRST AID MEASURES

IN THE TREATMENT OF MUSTARD GAS CASUALTIES

BY FIRST AID PARTIES:

It does not require a great deal of imagination to appreciate something of the problem which will confront First Aid Parties in the event of air raids in which, in addition to high-explosive and incendiary bombs, the enemy employs gas. During night raiding the effect of gas attack, coming after the initial destruction and disorganisation caused by the high-explosive and incendiary bomb, is likely to aggravate badly what has been found by experience to be itself devastating. For his guidance under such circumstances the First Aid worker has been taught that his first duty in the handling of mustard gas casualties is to save life, his second to save eyes, his third and fourth to treat skin and remove contaminated clothing. It is impressed on him that a contaminated but living casualty is better than one dead though decontaminated, and that it is of much greater urgency to give attention to saving eyes contaminated by liquid vesicant than to cleanse contaminated skin, a skin blister being much the lesser injury of the two. Having attended to the saving of life and eyes he arranges now that the casualty be removed if at all possible out of the contaminated area, before any further attempts are made at decontamination or first aid.
In addition to their difficulties due to darkness and the confusion and destruction caused by the raid, First Aid Personnel are themselves dressed in cumbersome protective clothing including stiff anti-gas mittens and a respirator. Add to this consideration the complicating circumstance that casualties must be treated within at most ten minutes if preventive treatment is to be effective, and the problem of timely and efficient treatment of the blister gas casualty will be appreciated.

First Aid and other A.R.P. personnel working under such trying conditions will be greatly tempted, or may even be compelled by circumstances, fatigue for instance, to remove respirators and loosen protective clothing. It is, therefore, no exaggeration to say that an exceedingly high percentage of casualties may result from among the personnel of the Civil Defence Services.

In considering the mustard gas casualty, to be kept in mind is the likelihood that non-persistent gases such as phosgene, with a long delay-period action, and the arsenical smokes, with their immediate violent sensory action, will be used in conjunction with mustard gas.
As already mentioned in Chapter I, it has been the experience in all cities which have suffered heavy bombardment from the air by high-explosives, that casualties were for the most part trapped in demolished buildings and reached only after considerable work by Rescue Parties. In the event of gas attack following on top of high-explosive attack, the number of casualties requiring immediate attention is likely to undergo a disproportionate increase due to a flood of casualties resulting from the penetration of houses by gas through broken windows and doors. It is not, one remembers, the policy of the Ministry of Civil Defence to gas-proof public or domestic shelters. If First Aid Parties were found to be in excess of requirements where high-explosive bombs alone were used, the reverse will be the experience when the additional weapon of gas is employed. The transporting of the additional non-injured gas casualties to a non-contaminated area, the preventive treatment and the initial disposal for cleansing treatment of such as are contaminated, constitute a responsibility which will fall as a heavy burden on the First Aid and other A.R.P. Services.

In anticipation of the above-mentioned eventuality certain preparation, to which reference has been made in Chapter I, has been arranged by the Civil Defence
Authorities, namely the provision of additional Fixed and Mobile Gas Cleansing Centres and of buckets of bleach cream outside of chemists' shops. The Mobile Gas Cleansing Unit can be located in close proximity to a contaminated area. The problem here will be how to direct the contaminated to this unknown Unit, especially in the dark. At night it will have to operate in darkness, and water supply beyond the initial amount it will carry may be a difficulty. The location of the Fixed Cleansing Centre, on the other hand, if there is one in the vicinity, is already known to the people in the surrounding district. This Centre has an emergency lighting system and even if water supply becomes a problem it has facilities for the removal of protective clothing, treatment with anti-gas ointment and the re-clothing of patients. Buckets of bleach cream in chemists' shops are hardly likely to be available during the night, when the greatest difficulties would arise; the shops would be shut and their owners at home.

The Ministry of Home Security has recently advocated that householders should be encouraged to provide cleansing facilities, to assist with contaminated persons, and to have anti-gas ointment available at their homes. This would involve the provision by householders of supplies of warm water and soap for
washing, empty dustbins for contaminated clothing and changes of clothing or some temporary covering such as rugs or blankets. The jet of a stirrup pump, with a bucket of warm water, is recommended for washing, the contaminated person himself applying soap. Householders with stirrup pumps, as well as organised Stirrup Pump Parties, should, therefore, be encouraged to function, the Ministry advocates, during gas attacks as HOUSEHOLDER ANTI-GAS or CLEANSING PARTIES. It is claimed that, with two or three people co-operating, cleansing can be carried out in a garden or scullery or garage with a stirrup pump, or even more simply, and yet effectively, by pouring water over the contaminated person, from a jug or a bucket. (This is known as the GOOD NEIGHBOURS' PLAN).

To continue the subject of Treatment by First Aid Parties, it is the duty of these to ensure, as far as possible, that contaminated casualties are given the essentials of anti-gas treatment before being passed on, contaminated stretcher cases to Hospital and contaminated walking cases to a First Aid Post. The minimum of initial preventive, first aid and anti-gas treatment, consists in the irrigation of the eyes with water, the application of anti-gas ointment to contaminated areas of the skin and the cutting of contaminated hair and removal of contaminated outer clothing. If treatment by First Aid Parties has been
successful, casualties reaching First Aid Posts and Hospitals should not present any major problem in anti-gas treatment.

On arrival at the Gas Incident First Aid Parties should halt a safe distance from the contaminated area, the leader alone going forward to contact the Senior Warden or Incident Officer. If the First Aid Party leader is the first of the Casualty Services to arrive at the incident it will be his duty to consult with the wardens present in order to obtain as accurate and complete information as is possible regarding the type of gas, the location of casualties and their number etc. Valuable information may also be obtained from residents in neighbouring houses or civilians in the area. Every endeavour should be made by the leader of the First Aid Party to arrive as speedily as possible at an accurate identification of the gas. If he is arriving to reinforce the work of Parties already on the scene he should contact the Medical Officer or Senior Casualty Official present and act under his instructions.

It is the duty of the leader, of course, to ensure that his First Aid Party is adequately clothed according to the type of gas present. For example, if anti-gas gloves become contaminated and have to be
removed he has to see that the now exposed hands are protected by treatment with application of Protective Ointment No. 2 as they become contaminated. He must take all necessary precautions, that he and his men do not themselves become casualties through ignorance or carelessness. When going off duty he must ensure their going through thorough cleansing treatment before resuming civilian clothing.

All the A.R.P. personnel, Rescue Parties, Wardens, Police and Fire, are trained in Life-saving First Aid Measures. They are expected, provided their other duties enable them to do so, not to await the arrival of First Aid Parties but to carry out urgent life-saving measures without delay. Similarly all A.R.P. Services should be instructed in the essentials of urgent Anti-Gas treatment, the saving of eyes, the treating of skin and the removal of clothing. The ideal would be that, in addition, the general public be themselves able to assist each other in a similar way. However very little progress has so far been made in the instruction of the general public. (In this connection see Chap.V).

The Treatment of Mustard Gas Casualties

BY FIRST AID POSTS (FIXED).

We have already seen that First Aid Posts are equipped to deal with contaminated walking cases,
by the provision of male and female Cleansing Sections.

If First-Aid-Parties have such cases on whom the First Aid Party has completed the essential initial anti-gas treatment will arrive at the Post having already had eyes and skin treated and contaminated outer clothing removed, but it must be assumed that, during darkness, at most only a small proportion of the cases arriving at Posts for anti-gas treatment will have had any previous treatment. In night raids the outer shed of the First Aid Post Cleansing Section will be in darkness. The personnel working in this shed will, of course, be wearing full protective clothing with respirator. They will see that no contaminated person is allowed to pass through the open shed into the undressing room of the Post until all the outer clothing, whether contaminated or not, has been removed.

The procedure requires that these articles of outer clothing be placed in a bag marked by a serial number, the personal belongings of the casualty placed in another bag marked with the same serial number and a numbered tab attached to the wrist by an elastic or other band. The bag with the outer clothing remains outside the Post, but the casualty carries the bag with his valuables into the Post with him. Any articles of underclothing contaminated by liquid gas should also be removed in the outer shed and placed in the bag with the outer clothing.
The difficulties of this complicated operation in the day-time would be very considerable. In the event of large numbers of anxious and clamorous casualties requiring cleansing treatment, delay would be inevitable and the whole procedure threatened. How darkness would further complicate such a situation needs no emphasising. Moreover, a proportion of the contaminated persons will also be injured. The injured will have to be given priority and it takes a long time to remove the contaminated outer clothing of an injured person in darkness, an almost impossible task by personnel in protective clothing. As no provision has been made in First Aid Posts for stretcher cases, and as the entrances to many Posts do not in any case admit the passage of a stretcher, it is difficult to see how these Posts will be able to cope with such a situation. It is recognised as essential that one of the doctors of the Post should be available to supervise the disposal of contaminated casualties as they arrive at the outer shed of the Post.

In the undressing room further procedure is facilitated by good light and warmth. The undressing room is protected from the contamination in the outer shed by an air-lock. Thus it is possible for the personnel in the undressing room to work without
respirators though they should wear eye shields to protect their eyes from accidental contamination, such as by their own fingers. In the undressing room the casualty's underclothing is removed and placed in a bag numbered by his serial number, then transferred to a bin with a tight-fitting lid. His respirator is not withdrawn unless contaminated with liquid vesicant. If contamination makes it necessary the hair is removed with clippers and the eyes are doused with water and a few drops of 2.5% albucid soluble instilled. The patient is now ready to proceed to the washing room where he is given a shower bath with soap. Showers are usually provided for this purpose in batteries of two. The patient is thoroughly soaked under the first, then steps between the first and second and is covered with a good lather of soap from head to foot, completing the washing process by stepping under the second shower and washing the soap off. This finishes his cleansing treatment. In the drying and dressing room he is dried and issued with clothing. Here his valuables are inspected and, if necessary, decontaminated either with paraffin or bleach cream and returned to him. The dressing room leads into the First Aid Post proper where the patient will receive such first aid treatment or rest or refreshment as he requires.
While this is the normal procedure for contaminated persons it has to be modified for those cases whose treatment has been delayed until evidences of mustard gas burning have already appeared. As already shown, signs of inflammation should have eye treatment limited to the installation of albucid soluble. Erythema of the skin should not be treated with anti-gas ointment or by washing with soap and water. The inflamed contaminated areas are washed with a solution of Dettol and a sterile dressing is applied.

The Treatment of Mustard Gas Casualties

BY CASUALTY CLEARING HOSPITALS.

In directing that all stretcher contaminated cases should be sent to Hospital for cleansing, the Department of Health has aimed at avoiding the difficulty of providing for such cases at First Aid Posts. We have seen that, as far as they can, First Aid Parties will undertake the initial urgent anti-gas treatment of these casualties before they are removed from the incident to the hospital. It is not expected that First Aid Parties will be able to carry out this treatment with injured contaminated cases even in daylight. In the more serious surgical cases drastic handling must often be contra-indicated and the casualty dispatched to hospital with the minimum of handling and delay.
On arrival at the Casualty Clearing Hospital the ambulance with contaminated stretcher cases will be directed to the Outer Shed entrance of the Cleansing Section. Hospital Cleansing Personnel will consist of a qualified Medical Officer, a nursing sister and trained nursing staff, all in suitable protective clothing. The casualties unloaded will be inspected by the doctor in the reception shed. The cleansing procedure to be adopted in each case should be decided according to the patient's surgical condition. As noted earlier, however, cleansing procedure in many Casualty Clearing Hospitals places the emphasis not on surgical condition but on contamination.

The writer has seen the following cleansing procedure for serious stretcher contaminated cases carried out during exercise tests in various hospitals throughout Scotland. In the partially exposed outer shed the patient's outer clothing is removed, no matter what the nature of his injury. In some hospitals the procedure requires that the patient be stripped naked here, and in some others, in addition to the stripping, all bandages and splints are removed and the patient transferred to another stretcher. In the next room, the washing room, underclothing if still on, is taken off. Contaminated hair is dealt with here, eyes are irrigated and the body surface is washed with soap and
From the washing room the casualty is carried into the hospital proper, having been transferred to a clean stretcher and clean warm blankets. The personnel working in the washing room are protected only against water from the sprays, except that they wear eye shields. The outer shed is separated from the washing room by an air-lock.

The personnel in the washing room are trained nursing staff. Following is an actual copy of instructions issued by one of the larger hospitals in Scotland.

HOSPITAL
DECONTAMINATION HUT.

A. RECEPTION OF PATIENTS.

Patients are received by four stretcher bearers who will carry patients from the ambulance either into the first room or lay them meanwhile in the open to await admission.

B. FIRST ROOM.

This room has accommodation for two or at most four patients. It is considered desirable to keep patients in the open on the ground adjacent to the hut rather than crowd the first room.

The Medical Officer in Charge attends in this room. Two Nurses at once douche the patient's eyes with warm water and instil liquid paraffin drops; they remove clothing, apply fresh splints if necessary, give morphia if necessary, and mark the dose on the label which is attached to him on admission in indelible pencil, e.g. M gr. 1/4. On the same label they mark the number of the clothes and valuables bags, and tie it to the patient's wrist or round his neck.

Two Students gather up the patient's clothes into a bag, attaching label with serial number and put it in a bin; they also put valuables into another
bag, label it with the same number, and hang it from a peg on the wall. They then carry the patient on the stretcher through the first air lock and place it on a table in the second room.

The Medical Officer, stretcher bearers, and nurses and students wear anti-gas suits, rubber boots, gloves and gas-masks.

C. FIRST AIR-LOCK.

D. SECOND ROOM.

This room has four zinc covered tables with overhead hard douches which deliver a gentle spray of water.

Eight nurses are ready, two at each table; they remove the upper and later the under blanket, as may be convenient; then wet the body, sprinkle it with liquid soap, gently lather, gently spray and dry; next, the head is attended in the same way. They remove all dressings and splints and swab round the edges of the wound with a ball of wool, using soap and water. Clean mackintosh is put under the wounded part, the patient is wrapped in clean blankets and transferred to a clean stretcher. Stimulants and medication are given as necessary. Nurses then put stretcher, blankets and splints out through the hatch. Two students bring in clean stretchers, blankets, etc. from air-lock, put the stretcher on the floor beside the patient, assist in lifting him on to the stretcher and carry him into the air-lock.

Nurses and Students wear anti-gas suits, rubber boots, and the nurses waterproof caps also.

E. SECOND AIR-LOCK.

For reception of clean stretchers, etc.

F. THIRD ROOM.

A Surgeon is in attendance.
Two Nurses carry out first-aid and readjust splints, under the direction of the Surgeon.
Two Students bring patient on stretcher from second air-lock; they also keep the lock supplied with clean stretchers, blankets and mackintoshes.
One Clerkess looks after the registration.
Stretcher Bearers are available, as required, for transporting patients to the Wards.
The nurses and students wear jaconette aprons and rubber boots.

G. OUTSIDE THE HATCH.

Two Students, in anti-gas clothing, put blankets in bins and stretchers in a pile. Bleach paste may be applied to stretchers which are handed over to the drivers of the empty ambulances. The students are also available to act as stretcher bearers for the reception of patients.

H. SPRAY ROOM.

On completing duty, staff remove anti-gas clothing and push it through the hatch into bins. Underclothing is put into bags, which are also pushed through the hatch. They then enter spray room from Second Room, and, after washing, put on dressing gowns and enter Second Air-Lock, and so into Third Room.

STAFF.

Medical Officer in Charge.
Surgeon in attendance.
Clerkess.
12 Nurses.
8 Students.
4 stretcher bearers.

N.B. It is considered most important that the transit of the patient through the department should be carried out with the greatest speed consistent with adequate cleansing from gas.

In this PROCEDURE it is to be noted that no distinction is made between degrees of injury. Even the most serious cases are put through the full process which includes: laying of patients in the open on the ground to await admission; the removal of all clothing
with application of fresh splints, if necessary, in the first room; the removal of all dressings and splints and the swabbing of the edges of wounds in the second room; washing of the complete body with soap and water and transference to a second stretcher, splints and dressings not being re-applied until the patient reaches the third room.

At the close of this Chapter are given TWO PROCEDURES - for First Aid Posts and for Casualty Clearing Hospitals - suggested by the writer to the Department of Health for Scotland and to the Ministry of Public Security in Northern Ireland. These procedures have both been put into practice in Ulster, and in Scotland the procedure for Posts has been issued by the Department in the form of a Memorandum.

**LEWISITE.**

Lewisite, chlorovinyl dichlorarsine, has the chemical formula $\text{ClCH}_2\text{CH}_2\text{AsCl}_2$. It is named after the American, Professor Lewis, who first isolated and described it in 1918. It was not used during the last war and has never been used in warfare. It is a heavy oily liquid, colourless in the pure state but darkens on standing.
CHEMICAL AND PHYSICAL PROPERTIES.

Lewisite is hydrolysed by water with the production of hydrochloric acid and organic oxides. It is much less stable than mustard gas from a chemical point of view although, in the absence of hydrolysis, it retains its vesicant properties for a considerable time. Like mustard gas it possesses powerful penetrative properties and can render clothing and other materials dangerous to wear or to handle. It is freely soluble in the ordinary organic solvents, in the petroleum series of hydrocarbons and in oils and fats. Its lipoid solubility is much greater than that of mustard gas allowing it to penetrate the layers of the skin with three times the rapidity. Unlike mustard gas, lewisite has a low freezing point - about - $13^\circ$ C. This is a difference of practical importance, since lewisite will still be an effective liquid in very cold weather when mustard gas may be frozen solid and its aggressive action in abeyance. The smell of lewisite resembles geraniums. It is a characteristic and very powerful smell which would drench the whole area in which it appeared.

The points to note are: that it is easily destroyed by water, that it is easily recognised by its distinctive odour and that it has the power of rapid penetration of the tissues.
Typical lewisite blister.

Photo. C.
PHYSIOLOGICAL ACTION.

The physiological action of lewisite is similar in many ways to that of mustard gas but there are important differences. As in the case of mustard gas there is delayed action in the production of skin burns but the delay is less. The typical lewisite blister resembles a pearl standing on the skin surface as is clearly seen in the PHOTOGRAPH opposite. The action of lewisite is not, however, insidious as the vapour causes marked irritation of the eyes and nose, and the liquid causes immediate tingling of the skin and violent discomfort in the eye from the onset.

In contrast to mustard gas contamination, which is never followed by a general systemic poisoning through absorption of the chemical, contamination of a mass of skin by liquid lewisite may produce acute arsenical poisoning in which all the organs of the body may be affected and arsenic may be found in all the tissues. It has been stated that the lethal dose would be 1 c.c. of the liquid absorbed through the skin surface and that 0.3 c.c. would cause serious illness.

Lewisite 1 is lipoid soluble and penetrates the skin very quickly. It goes through the epidermis and dermis and reaches the muscle within ten minutes. It
Diagram I.

Diagram II.

FATE OF LEWISITE IN THE BODY

CAPILLARIES

LIVER

NECROSIS AND HEMORRHAGE

CIRCULATION OF LEWISITE

BLOOD

KIDNEYS

NITRATES AND HEMORRHAGE

FORMATION OF LEWISITE OXIDE AND PEROXIDE VAPOR

LEWISITE DERIVED IN KIDNEYS

BONE MARROW

REGROWTH
Diagram I. Shows the typical changes in the blood following the application of Lewisite to the skin of rabbits. Within 24 hours there is a rise in the haemoglobin and red cells as well as a rise in haematocrit value. This state of haemocentration which lasts 3 or 4 days is accounted for by a loss of fluid from the blood stream. It can be seen that the fall in blood volume is entirely due to a loss of plasma; the total red cell volume remains constant. Associated with this loss of fluid there is a fall in the plasma protein concentration, due to a loss of albumin. The globulin actually rose slightly in this experiment. To this series of changes the term "Lewisite shock" has been applied.

At a slightly later stage there is a marked rise in the plasma N.P.N. This appears to be due in many cases to defective glomerular filtration - a consequence of the low blood-pressure during the stage of shock; but in some animals there is evidence of a transitory depression of renal function with albuminuria.

Diagram II. Summarises the main pathological effects of lewisite in a diagrammatic form. These are briefly:

1. Locally - Burn and blister.
2. In the bloodstream. a. Increased capillary permeability resulting in shock.
   b. Some red-cell destruction with consequent re-action.
3. Excretory channels.
   a. Liver - Producing focal necroses in the liver and haemorrhagic lesions of the biliary tract.
   b. Kidney - producing only mild functional damage.
is converted to lewisite oxide \((\text{Cl.CH}_2\text{CH.ASO}_2\text{OH})\) which is taken up by the body lymphatics into the general circulation. It can be detected in the blood as lewisite oxide for twenty-four hours. It reaches most tissues and causes haemorrhagic inflammation of the gall bladder and bile duct, necrosis of the liver, inflammation and degeneration of the kidney and concentration of the blood as in "shock". The DIAGRAMS opposite, by Professor Cameron, Porton, illustrate the results of his recent experimental work with lewisite in animals.

**TREATMENT OF LEWISITE CASUALTIES.**

**Preventive Treatment:**

Since penetration of liquid lewisite into the skin takes place with great rapidity, there is need for speed, above all things, in preventive treatment. No. 1 Bleach Ointment is ineffective against lewisite and should never be employed. Protective Ointment No. 2 and Bleach Cream are effective by virtue of the water they contain. Aqueous Bleach Cream and water act by hydrolysing and oxidising lewisite into compounds which are still toxic on absorption, though non-vesicant. These preparations or water should be applied without delay, within five minutes, to have any effect on the penetration of liquid lewisite. Their action is relatively slow and, even if vesication is prevented,
serious symptoms of arsenical poisoning may still arise from absorption of the toxic products if enough liquid lewisite gets on to the bare skin. Aqueous Bleach Cream and No. 2 Ointment cannot be regarded as more than partially successful in the treatment of liquid lewisite contamination of the skin.

Hydrogen peroxide (20 vols.) or hyperol solution (20 gms. to 100 cc. water) oxidises lewisite more quickly to an arsenical compound of lower toxicity (Chlorovinylarsenic acid - Cl \( \text{CH} \vdash \text{CHAs} \vdash \text{CH}_2 \)). These will not only prevent the vesication action of lewisite but will, provided they are applied within an hour of contamination, lessen the serious symptoms which may otherwise result from absorption.

Preventive treatment consists in the performance of the following three essential actions within five minutes of contamination:

1. Any liquid lewisite on the skin should immediately be mopped up with a rag, cotton wool, or any other suitable article available.
2. Bleach Ointment No. 2 or Bleach Cream or water should be applied to the skin.
3. The skin surface should be thoroughly washed to remove the still toxic oxidised lewisite products from the skin.
If hydrogen peroxide or hyperol solution is available the skin should be thoroughly swabbed for two minutes with this. A piece of lint soaked in hydrogen peroxide or hyperol solution should be applied over the contaminated area for a period of from $1\frac{1}{2}$ to 2 hours. The oxidising action of $\text{H}_2\text{O}_2$ on the lewisite reservoir in the contaminated skin has been effective in preventing death in rabbits when applied within one to two hours of contamination.

**PREVENTIVE AND FIRST AID MEASURES**

**IN THE TREATMENT OF LEWISITE CASUALTIES**

**BY FIRST AID PARTIES:**

The A.R.P. Handbooks have not been brought up to date in their account of the first aid treatment of lewisite cases. The equipment of casualty personnel does not include an effective anti-lewisite ointment. In their training personnel are not being taught that the absorption of relatively small amounts of the liquid may produce fatal consequences unless adequate treatment is applied with great rapidity. The A.R.P. Services in general still regard lewisite as a second rate vesicant gas. Instructions given to First Aid Parties in the treatment of lewisite casualties should not follow altogether the lines laid down in the case of mustard gas. The order of urgency and treatment should be: save life - and the removal of liquid
Lewisite from the skin must be regarded as a life-saving measure — remove clothing, treat eyes. It is still the exception to find casualty personnel who have received this instruction.

Official teaching with regard to the initial disposal of the lewisite casualty is the same as for mustard gas: walking cases are sent to First Aid Posts and stretcher cases to Casualty Clearing Hospitals. To be satisfactory the instructions should be that all cases suspected of skin contamination with liquid lewisite, and particularly those with commencing erythema or blister formation, whether stretcher cases or not, and all eye cases, should be sent without delay to Hospital. Lewisite blisters should be opened by First Aid Party personnel. This they are taught to do.

As the presence of lewisite will always be recognised by its odour and by the immediate and violent sensory irritation caused by its vapour, it will not have the initial advantage of insidiousness possessed by mustard gas. The irritation of the eyes and nose by the vapour is quickly relieved on adjusting the respirator or reaching pure air.

Since the danger to First Aid personnel from
lewisite contamination is a serious one, considerably more to be feared than that from mustard gas. Steps should be taken to improve the knowledge of all A.R.P. personnel on dealing with liquid vesicant contamination of their own skin by means of hydrogen peroxide or water. They should be taught that neither Aqueous Bleach Cream nor No. 2 Ointment can be regarded as satisfactory anti-lewisite preparations.

As a complication of air bombardment by high-explosive and incendiary bombs against our cities, lewisite gas by reason of its systemic action, adds a new terror not present in mustard gas, but it will not do much to aggravate the already complicated situation facing First Aid Parties at gas incidents. The initial sensory irritation produced by lewisite vapour may cause some immediate alarm in the population which the more insidious mustard gas would not cause. It is the nasal irritant, as shown later, that is most to be feared in this connection.

BY FIRST AID POSTS:

The observation already made regarding the inadequate training of First Aid Parties in lewisite gas poison applies equally to the personnel of First Aid Posts where it is the belief of qualified staff and volunteer personnel alike that No. 2 ointment
applied within 5 to 10 minutes will destroy liquid lewisite and prevent all its effects. Hydrogen peroxide is now issued to First Aid Posts but the necessary instructions regarding its use are lacking. The urgent need for the hospitalisation of all cases with more than the slightest lewisite skin blistering is not appreciated, and it is certain that many cases may be treated by simple dressings and sent home. The attention of various authorities has been drawn to these facts, though unsuccessfully. The obvious precaution would be to take the comparatively simple action necessary to ensure that the personnel of the Casualty Services receive this small addition of vital information.

BY CASUALTY CLEARING HOSPITALS:

The problem of the decontamination of the contaminated casualty at Casualty Clearing Hospitals has already been discussed under Mustard Gas. The special problem presented in the medical treatment of cases suffering from arsenical poisoning due to the absorption of liquid lewisite through the skin hardly falls within the scope of this thesis. Our knowledge of the treatment of such cases is extremely limited. Judging by the results of animal experiments carried out recently by Prof. Cameron at Forton, all of these cases will present symptoms of shock, accompanied by
plasma loss and increased concentration of the blood. As lewisite continues to exert its toxic action so long as it is being absorbed, treatment by transfusion of plasma is unlikely to be successful unless the reservoir in the contaminated skin has been treated at a sufficiently early stage with hydrogen peroxide. Vedder states that the method of excision of the burn with the removal of the skin and subcutaneous oedematous tissue, and free drainage, gives good results from twelve to twenty-four hours after contamination. This has been largely confirmed in work done at Porton with rabbits. Life has been saved in experimental animals by excision of the skin up to four hours after contamination with lethal doses of lewisite. Destruction of the eye must be regarded as an inevitable consequence of contamination with liquid lewisite. Fortunately such cases are likely to be very rare, the irritant effect of the vapour resulting in immediate and involuntary closing of the eyes. But in the rare event of liquid entering the eye it must be assumed that efficient treatment, the instillation of an antidote - and there is one -, would not be possible owing to intense pain and spasm even if it could be applied in time, a matter of seconds. Unfortunately in mustard gas contamination of the eye this antidote is contra-indicated.
Information available concerning lewisite poisoning is still inadequate. The reprint of the "Medical Manual of Chemical Warfare, 1940" is an advance on previous Handbooks, especially on the A.R.P. Handbook No. 3, but even in it, regarding the prognosis of eye burns due to liquid lewisite, there is only the unhelpful comment: "The Prognosis in liquid lewisite contamination of the eye is even more serious than with liquid mustard gas".

To sum up, the training of the Casualty Services in lewisite gas poisoning and their equipment for the preventive and first aid treatment of the lewisite casualty, do not compare favourably with their training and equipment in the case of mustard gas. The official attitude to lewisite being, "just another vesicant gas like mustard", the A.R.P. personnel receive the impression that, because it is much less insidious than mustard gas and decontamination easier, it is much less important. The danger resulting from this deficiency in knowledge and equipment exposes the Services to unnecessary risk and materially affects their value as First Aid Shock Troops in the defence of the civilian population.
The two gases previously considered, Mustard Gas and Lewisite, are persistent gases and liquids, both capable of incapacitating large numbers of persons by bodily disablement. Phosgene, in contrast, is non-persistent and a true gas. Though not so effective a casualty-producer as mustard gas - 10% of phosgene casualties as against 80% mustard gas casualties resulted from gas shell attack in the 1917-18 period in the last war - it is highly lethal, as is shown by the fact that 80% of all gas deaths were due to phosgene.

CHEMICAL AND PHYSICAL PROPERTIES.

Phosgene is a true gas under normal conditions of temperature and pressure. At low temperatures it forms a colourless liquid and is stored in this form. It is non-persistent and belongs to the non-blister group of war gases. It is a colourless gas at ordinary temperature. Where liberated as a cloud it may have a whitish appearance due to condensation of water vapour in the air. For all practical purposes we may assume that phosgene gas encountered under raiding conditions will be invisible. It has a characteristically pungent odour like musty hay or dried grass and it is liable to produce some immediate
irritation and slight coughing.

**PHYSIOLOGICAL ACTION.**

It has already been noted that phosgene may cause immediate irritation and cough. This might be marked in heavy concentrations of the gas. There are innumerable instances, however, during the Great War of troops being fatally gassed without having experienced initial symptoms. Concentrations likely to be met in the work of our First Aid Parties will present them with casualties who are unaware of having been exposed to the gas. Blitz conditions are themselves likely to produce on the population of an area greater nervous and physical reactions than the often mild and transitory initial effects of phosgene in an invisible cloud. The characteristic odour is unknown except to the very few, and even those who have been trained to recognise it would certainly fail to do so in the presence of other odours as from artificial smoke screens. Phosgene gas, used in conjunction with air raids on cities, must be regarded, therefore, as 100% insidious. The A.R.P. Services should be warned that they will see nothing and smell nothing, and that the initial physiological effects may be negligible.

It is a characteristic of phosgene that, whether
or not there has been immediate sensory irritation of the respiratory passages, a period of from one to four or five hours may pass before symptoms of pulmonary oedema are apparent. During this period of delay victims may be themselves unconscious of any serious trouble. They may not complain of feeling ill; they may not seek medical attention or, if suffering from the effects of other gases or injury, they may not be recognised by First Aid Parties or at First Aid Posts or Rest Centres as phosgene casualties. The problem which these casualties present has been reasonably well explained to the personnel of the First Aid Services.

In recent months there has been a tendency on the part of some official instructors of the Home Office to minimise the importance of the delay period in the teaching of phosgene gas poisoning. Their opinion is that phosgene victims will be ill and conscious of their condition from the moment of exposure, though they agree that symptoms of true pulmonary oedema will be considerably delayed.

The last war provides many examples supporting the view that such casualties may be free from symptoms until pulmonary oedema supervenes. Two examples from the Official History (Medical) of the Great War will
suffice. In the first instance, two companies of Seaforth Highlanders were attacked at 3 a.m. one morning by phosgene bombs. Three of the Highlanders complained of feeling ill. At 5 a.m. they had breakfast and after the meal a number of them vomited and complained of difficulty in breathing. Several of them woke up after a short sleep with similar symptoms; one sergeant died soon after breakfast and another suddenly collapsed and died while taking the names of the sick men. Though only three had complained of initial symptoms there were 91 casualties of whom 18 died.

In another case, in February 1917 a chemist was accidentally gassed with phosgene at 1 p.m. He sat down on a chair, looking pale and coughing slightly. At 2.30 p.m. he was hardly coughing at all, pulse normal, showing no distress or anxiety and talking freely with his friends. At 5.30 p.m. coughing with frothy expectorations commenced. His condition rapidly deteriorated. He died at 6.50 p.m. without any great struggle for breath.

Cases similar to these two might well be common experience under air raid conditions, and our First Aid Personnel should be encouraged to make themselves thoroughly versed in advance with such information as
A.R.P. Handbooks afford for the diagnosis of phosgene poisoning during the delay period.

**SYMPTOMS.**

Early **DIAGNOSIS** of the phosgene casualty is of the greatest importance. Apart from information available regarding the type of gas identified by the Gas Identification Service and clinical evidence presented by other cases in the area, there are clinical signs and symptoms of poisoning which can be elicited, by Medical Officers especially, before the onset of serious pulmonary oedema. In the course of examination, such cases should be asked to describe their symptoms, leading questions being avoided. A strong presumptive evidence of gassing by phosgene is pain or coughing on deep inspiration, and signs helpful towards the diagnosis include a sense of exhaustion, pallor of the face, a rapid pulse, unusually short and rapid breathing, and vomiting.

**PULMONARY OEDEMA.** The action of phosgene on the mucous lining of the respiratory passages may not be acute, and in this it differs markedly from chlorine. It exercises its main effects in the lungs on the alveoli, the walls of the capillary vessels and the terminal bronchioles. Phosgene is hydrolysed in the alveoli of the lungs, thus the action of phosgene is
really the action of hydrochloric acid, generated in situ \((\text{CO}_2\text{Cl}_2 + \text{H}_2\text{O} = 2 \text{HCl} + \text{CO}_2)\). The complication to be feared from the irritant effects of the hydrochloric acid is the onset of acute pulmonary oedema. The rate of onset and the degree of oedema will depend on the concentration of the gas and, in a lesser degree, on the duration of exposure. In the last war, in every case of death from phosgene poisoning which was examined by post-mortem, acute pulmonary oedema was found in the lungs. On p.94 in the phosgene ILLUSTRATION, the piece of lung tissue shown is almost entirely useless for the aeration of blood. There is marked oedema and some emphysema. The bronchus also contains oedema fluid. The lining epithelium is intact and there are no pus cells in the oedema. In the second ILLUSTRATION the piece of lung from a case of mustard gas poisoning shows the lining epithelium of the bronchiole completely destroyed and its lumen filled with fibrin and pus cells. The bronchiole is surrounded by a zone of haemorrhage. Infection is also appearing in the alveoli adjacent to these inflamed tissues. There is entire absence of pulmonary oedema and disruptive emphysema. These pathological changes in the bronchioles and in the alveoli indicating acute septic pneumonia, contrast sharply with the simple oedema resulting from phosgene gas poisoning.
With the onset of serious circulatory failure resulting from anoxaemia due to pulmonary oedema, a vicious circle is established. Increased viscosity of the blood, pressure on the capillaries by the oedema fluid in the lung, dilatation of the right side of the heart, the failure of the oxygen supply to the tissues, and particularly to cardiac muscles, each plays its part. Should the patient by his exertions produce a sudden oxygen demand, the result is liable to be collapse and death. The development of pulmonary oedema may be both precipitated and intensified by undue muscular effort, or such effort may increase the consumption of oxygen at the very time when the water-logged lung is capable of supplying only a minimum quantity to the tissues. The gravity of the case and the extent of the pulmonary oedema cannot be discovered from physical signs in the chest. Cases are judged by the colour, mental condition, respiration and pulse. No further information is to be gained by physical examination of the chest.

Phosgene cases are characterised, then, by insidious onset, sudden development, after the delay period, of respiratory distress leading on to a condition of grey or pallid asphyxia. In the last war cases of sudden death during the first day were rare. Typical severe cases were characterised by the rapid
development of pulmonary oedema on the first day. In such cases physical effort immediately exaggerates the condition. It was found in France that the eating of an ordinary large meal might be the immediate cause of the sudden development of grave features in a previously mild case. Whatever the effort may be, it may demand more oxygen than can be supplied by the damaged lungs, and, overburdened and underoxygenated, the heart muscle fails.

Cases suffering from CHLORINE poisoning, in contrast to phosgene cases, are characterised by violent onset. Symptoms are severe from the beginning, and the initial asphyxia state with the blue type of asphyxia and intense venous congestion usually precedes the more serious development of grey asphyxia.

ASSESSMENT OF PHOSGENE GAS ATTACK.

Here we are dealing with a non-persistent gas. A persistent liquid gas remains on the spot where it has fallen. The non-persistent gas drifts along before the wind. Though the cloud formed by the phosgene may persist only for a few minutes those persons caught by the cloud in the immediate vicinity of the burst would be exposed to grave danger, their safety depending on how quickly they can adjust the
respirator. The public should be trained to hold the breath while doing this. According to the degree of their skill and speed in this manipulation they may one day soon be resolved into the "quick and the dead".

THE PHOSGENE GAS BOMB.

To be really effective phosgene would have to be used in large bombs of from 250 kilos to 1 ton. If 25% of the total load of possible bombs employed were gas it is possible to envisage a scale of attack in which 25 tons of gas could be unloaded in one hour over an area of 25 sq. miles. The Germans have made a careful study of the movement of air in streets, with a view to applying in gas attack the knowledge they have thus accumulated. It is to be expected that the first attack would be in the nature of a surprise, and very heavy. A night attack would be the most likely, in view of past offensive action against this country. If at night, a proportion of the bomb load used would inevitably consist of incendiary and high-explosive bombs. This would bring the Civil Defence Services out of doors, and by breaking windows procure the entrance of gas into houses while the bulk of the population was asleep. It is officially estimated that on half the days in the month the weather would be suitable for offensive action against this country with
phosgene gas bombs.

The length of time for which phosgene from a bomb could be effective at any one point would be twenty minutes. Falling in a street the gas could fill the street up to roof-level. This cloud would have a concentration of about one in a hundred. Assuming the wind to be 5 miles per hour the gas cloud would travel sixty yards per minute. There would be two zones of danger, that in which the concentration is greater than one in six thousand and that in which the concentration varies between one in six thousand and one in thirty thousand. The first zone would be lethal to any unprotected person. In the second zone the danger would be still very considerable, but outside these zones there would be little more than lachrymation and coughing. The first zone might extend to some 300 yards in each of two directions in a crosswind, and the second zone for a further 100 yards. In narrow streets, zone one might extend to 1,200 yards. People in the houses bordering this zone would be in the same danger as those in the streets if the windows are without glass and doors destroyed by explosive action. The gas from the street might be drawn into basements and ground floors.

It is officially estimated that phosgene gas bombs
will not reinforce each other; that, except in abnormal places and conditions, the period of danger from phosgene gas at any one spot will not exceed twenty minutes; that there is no possibility of an area, even of a square mile, remaining many hours under a lethal concentration of gas. With a 250 kilo phosgene bomb the zone of lethal concentration is in general a square with sides 300 yards long.

FIRST AID TREATMENT.

OF PHOSGENE CASUALTIES

BY FIRST AID PARTIES:

Because it is not persistent, phosgene gas presents a simpler problem than mustard gas and lewisite to casualty personnel in first aid treatment. The exceedingly insidious character of phosgene, however, gives it a lethal danger far greater than that of the persistent gases. Personnel who are tempted to relax discipline under the stress of the exacting circumstances will be themselves in danger of becoming phosgene casualties. With the definite object of obtaining this result against personnel, the enemy would probably use phosgene in combination with the other main gases, mustard gas and the nasal irritant.

When a non-persistent gas has been used in an attack, First Aid Parties will first ascertain whether
or not phosgene has been employed. Advice may already have reached them through their headquarters to this effect, or the responsible officials at the scene of the incident may have all the information necessary for their guidance. Doubtless this latter will be usual should gas raiding become common, for experience will quickly teach us valuable lessons. In the initial raids, likely to be surprise raids, heavy, and at night, casualty personnel will have to rely very much on their own resources and it is certain they will be faced with desperately difficult situations. In preparation for this their training cannot be too earnestly directed and revision cannot be overdone. Present training in this respect is much below the essential standard.

Success in first aid treatment of phosgene casualties depends on getting the patient to hospital and into bed between sheets with hot water bottles before the onset of serious symptoms. In the meantime, the First Aid Party is responsible for ensuring absolute rest and warmth for these patients during transport. All suspected of having been seriously exposed to phosgene should be treated as stretcher-cases from the outset and strictly prohibited from walking, even though they may protest that there is little the matter with them. Suspected casualties can
better be examined if removed to pure air. Casualty personnel should look for such symptoms as tightness or constriction of the chest, increased rapidity of pulse and breathing, vomiting, and a history of cough and irritation of the throat. All phosgene cases should, then, be made stretcher cases, kept warm with blankets and hot water bottles and sent direct to Hospital.

**BY FIRST AID POSTS:**

First Aid Posts should not consider themselves capable of acting in any capacity other than as Clearing Centres for phosgene casualties. Circumstances may necessitate the evacuation of such casualties from the Incident to a Post and their retention there for a considerable time. If this happens it is to be regarded as a purely temporary measure to be terminated at the earliest possible moment. No medical official could be excused for retaining and treating phosgene cases at a Post if he could have evacuated them to Hospital. Phosgene cases temporarily accommodated in a Post are to be kept at rest and warm and under constant observation. It is not intended that facilities for oxygen treatment for these cases should be available at Posts. None the less, in the event of unavoidable delay in their evacuation to Hospital, it may be necessary to obtain
mobile oxygen apparatus through a Medical Officer of Health. Such an emergency should be anticipated by Medical Officers of First Aid Posts.

**BY CASUALTY CLEARING HOSPITALS:**

Phosgene casualties may not reach Casualty Clearing Hospitals for at least two hours, and under blitz conditions many must be delayed for a longer period. Undiagnosed cases will be discovered only with the onset of symptoms of acute pulmonary oedema. Thus the phosgene case will present the Casualty Clearing Hospital with the problem of the lung irritant case in the stage of acute cyanosis requiring immediate active treatment.

Because of the risk to such patients in moving them and the importance of early oxygen administration, it is necessary that arrangements should be complete for the immediate equipping of all Casualty Clearing Hospitals from Central Depots with apparatus, cylinders, piping, masks etc., for continuous oxygen treatment. This means that from three to ten litres' flow of oxygen per minute per case will be required for a period up to 48 hours, depending on the severity and duration of oedema.

The recently adopted policy of the Central Authority
is to equip Base Hospitals and not Casualty Clearing Hospitals with facilities for oxygen administration. This necessitates the evacuation of the phosgene casualty from the raided area to the distant Base Hospital centre. This policy is, of course, medically unsound, for once a case has developed pulmonary oedema treatment should be applied at once if life is to be saved. This policy does, of course, simplify the problem for the Central Department concerned, is much less costly in its initial outlay and in the rural areas where most of its Base Hospitals have been built there is ample accommodation for the interment of all the phosgene cases likely to occur in Scotland.

**TYPE: HARASSING**

**NASAL IRRITANTS.**

The Arsenical Smokes mentioned in the official literature are (D.M.) Diphenylamine chlorarsine, 
(N.H₄(C₆H₄)₂ClAsCl); (D.A.) Diphenyl chlorarsine, (Ph₂AsCl); and (D.C.) Diphenyl cyanarsine, (Ph₂AsCN). Of these D.C. is the most effective. It is at least three times as effective as D.A. and twice as effective as D.M. At one period in 1918, as high as 17.3% of gas casualties in one Gas Centre were due to nasal irritants. The Germans considered the arsenical irritants of great offensive value in the last war,
employing them usually in conjunction with phosgene. Though the method of dissemination - by gas shell - was not very efficient, the nasal irritant proved useful to them in preventing troops from adjusting their respirators, and thus rendering them more exposed to the effects of the more lethal phosgene gas. There is no doubt that the numbers of phosgene cases were increased in this way. The nasal irritant also had a marked influence on morale, their effect in lowering morale being, according to Vedder, probably out of all proportion to their value as casualty-producers.

CHEMICAL AND PHYSICAL PROPERTIES.

The nasal irritants are solids and therefore form non-persistent clouds. The cloud is composed of very minute particles of the solid arsenical compound. Because of this these particulate clouds are also called toxic smokes or poisonous smokes. The cloud is quite invisible to the naked eye. It is unlikely that useful samples of nose irritant gases will normally be obtained at the incident. Physiological detection is likely to be the one practicable method of identification available.

The charcoal of the respirator container has no protective value against arsenical smokes. To trap
these solid particles there is in the respirator container a special filter device which has recently been strengthened by the addition of contex.

**PHYSIOLOGICAL ACTION.**

Nasal irritants are of importance in warfare because of the great tactical value of the immediate and violent physiological action produced by them. They exercise their effects on the sensory nerve endings of the mucous membrane of the nose, throat, nasal sinuses and respiratory passages etc. After a delay of from one to four minutes the victim becomes conscious of slight discomfort which increases in severity until he is in acute distress, and the nasal irritants are capable of producing these alarming effects in the amazingly low concentrations of 1/10,000,000. Phosgene, in comparison, is effective in concentrations of 1/100,000.

**SYMPTOMS.**

**IMMEDIATE.**

The nasal irritants may be regarded as substitution products of arseniuretted hydrogen (Arsine), $\text{AsH}_3$. The ordinary poisonous effects of arsenic are largely masked by this change, the chief symptom being the intense irritation of certain sensory nerves.
In 1881 La Coste described the action of ethyl-dichlorarsine; "It has a very powerful irritant action on the mucous membrane of the eyes and nose, causes painful blistering of the skin, and is very dangerous for those working with it, since its vapour causes respiratory embarrassment, faintness, and long lasting paralysis and anaesthesia of the extremities." The characteristic symptoms of nasal irritant poisoning are acute pain in the nose and accessory sinuses, repeated sneezing, a feeling of constriction and pain in the chest, pain referred to the gums and teeth, lachrymation and salivation with nausea or vomiting. In many cases acute mental distress is marked. The patient is the picture of unutterable misery and is in a state of great alarm.

The effectiveness of the nasal irritants depends on the amount inhaled. The irritant effects will continue to increase to their maximum whether or not the victim adjusts his respirator or withdraws to pure air. Victims caught by this poison gas may adjust their respirators before symptoms appear. The experience of the slowly developing action of the arsenicals and continuing aggravation of symptoms may well, in those who do not understand this gas, undermine confidence in the respirator. In any case so acute are the symptoms that it will be impossible for
many victims to retain their respirators in position.

SEQUELAE.

Giddiness was an early symptom sometimes complained of in the fighting in France in the Great War. A few cases who quickly lost consciousness remained comatose for several hours. Others passed into a lethargic condition but did not lose consciousness. Intense mental distress was always very marked in these severe cases. Occasionally mental control was temporarily lost and instances were reported of victims acting as if they had been driven mad by their pain and misery. Some cases committed suicide.

In addition to changes in mental condition interference with motor power was not infrequent - temporary paralysis of one of more limbs was seen in several cases. There were other instances in which a more generalised motor weakness appeared, revealed in uncertain gait, swaying when standing and sometimes in complete inability to walk, accompanied by severe pain in the joints and limbs.

As well as these motor changes in the early stages, sensory changes occurred later in the course of the illness. The motor changes can possibly be
ascribed to toxaemia of the central nervous system - of a transitory character. The sensory changes were mainly a disturbance of epicritic sensation leading to anaesthesia - about the fourth day. In all cases improvement was rapid and recovery complete. No case of fatal poisoning of British troops by nasal irritants was recorded in the last war. No cases of true pulmonary oedema which could definitely be attributed to their action were met with in France but a certain number of patients exhibited signs of bronchial catarrh for a limited period. In animals after fatal doses in which the poison had penetrated to the ultimate recesses of the lungs, pulmonary oedema was common and frequently severe. Diphenyl-chlorarsine has roughly the same toxicity as phosgene, the same high degree of concentration being necessary to cause fatal injury of the lungs.

**ASSESSMENT OF NASAL IRRITANT ATTACK.**

The main details given under phosgene can be applied here. No separate official assessment has been made in the case of the arsenical irritants. The Chemical Adviser to the Vth Corps in the last War drew attention to the value of nasal irritants in weakening the physical and mental powers of its victims and in lowering morale. He reported, "It is a negligible menace so far as causing serious and prolonged
casualties; but it is a very real factor in a battle, particularly in a retreat, where both its moral and physical effects may greatly influence the issue during a limited number of hours." He was of the opinion that the effects of all but the mildest doses resulted in a general decrease of stamina and resistance and contributed to the loss suffered in prisoners taken by the enemy.

The Official Medical History of the War states, "There can be no doubt that the blue cross shells were a very inadequate means of disseminating effectively the arsenical compounds of high boiling point; had higher concentrations been obtained in the field the after effects might have been much more serious. Yet the main importance of this class of compound from the military point of view rests in the extreme sensory irritation and mental distress provoked by mere traces of the substance in the air, effects which can only be avoided by the use of an efficient respirator." .......

"In respect to their immediate action the arsenical compounds differ fundamentally from those warfare gases whose main action is delayed in appearance.... Inhalation of the arsenical warfare gases is followed by dramatically rapid effects - nausea, pain, conjunctivitis, sneezing etc. and the full action of the poison is reached within a surprisingly short space of
time, whilst disablement results from the inhalation of concentrations of the poison so small that in the case of other warfare gases they would be totally ineffective. This feature serves to place the arsenical warfare gases in a separate category for tactical employment, and they may be regarded as agents specially adapted for inducing immediate disability, a comparatively brief and harmless action as judged from the purely medical aspect, but one which may have far-reaching effects at the moment of combat from a tactical point of view."

Vedder states, "The number of casualties that may be expected from the use of these irritant smokes will depend chiefly upon the effectiveness of gas discipline, but may be considerable. It is evident that, although the Germans overestimated the value of these compounds, especially as employed in explosive shell, they were good casualty producers and probably lowered the morale out of all proportion to their casualty producing powers."

Prentiss declares, "The 'M' device (the thermo generator for the more effective dissemination of the nasal irritants) was never used in France; but if its secret had been kept there is not the slightest doubt that its effect on the enemy, both moral and physical,
would have been overwhelming and if it had been properly and fully exploited it would have had a more important bearing on the course of the war than any other measure that was put to a practical trial on the battle-field or that was ever considered”.

The relevant question arising from the foregoing quotations concerns the possible tactical value of the nasal irritants in conjunction with high-explosive, incendiary, mustard gas and phosgene bomb attack against large centres of population. Could the enemy disseminate the arsenical irritants in sufficiently effective concentrations after preliminary bombardment with high-explosives and incendiaries, and then follow them with phosgene and mustard gas bombs, the nasal irritants would possibly be the decisive factor in the success of such a raid, a success so terrible in its consequences to the attacked as to stagger imagination. This is no fanciful or exaggerated picture. Practice gas tests carried out recently with half-pound containers of nasal irritants in the streets of a Scottish city on a windy day have been exceedingly effective over an area 300 yards square. The gas discipline of the general public of our cities is almost non-existent. During attack at night respirators would have first to be found before they could be adjusted, and meanwhile through damaged
doors and windows nasal irritant gas, so effective in preventing the wearing of the respirator, would be gaining ready entrance. In experiments carried out by the Home Office it was found that of all the war gases the only one which had any real power of penetration into closed rooms was the nasal irritant, this, no doubt, on account of its effectiveness in very minute concentrations.

**FIRST AID TREATMENT**

**OF NASAL IRRITANT CASUALTIES**

**BY FIRST AID PARTIES:**

It is only when the tactical value of the nasal irritant is understood that one can approach a full appreciation of the magnitude of the task that would confront the authorities in full scale high-explosive, incendiary and gas attack. In the anti-gas training of the A.R.P. Services the official First Aid Treatment laid down for the nasal irritant victim can be summarised under two instructions:— Remove the patient from the gas; Reassure him with the information that he will soon be quite well again. After a disappointingly brief summary of the nasal irritants, A.R.P. Handbook No. 2 concludes, "All this, plus the fact that these materials act in extremely low concentration, makes the nose irritant problem very important from the First Aid point of view". It is
Quite evident that the task of "reassuring" a large number of agonised and panic-stricken nasal irritant victims would be altogether outside the sphere of the First Aid personnel. Probably our military authorities realise to the full the immense tactical value of the nasal irritant in offensive action against the enemy, and could avail themselves of its tremendous disabling power if opportunity present, but, whether that is so or not, our Civil Authorities do not yet appear to appreciate its potential danger and have not taken the steps necessary to defend our cities against its employment by the enemy.

By First Aid Posts:

In the first aid and medical instruction given in A.R.F. Handbooks the nasal irritant casualty is dismissed shortly in the statement that in the great majority of cases a brief period of rest is the most that is required. In a "few exceptionally severe cases, however, pain may call for medical relief, when the inhalation of a little chloroform may be found of transitory assistance. A five per cent solution of sodium bicarbonate for nasal irrigation or as a gargle will help to allay the irritation of the nose and throat."

And this is all the advice given.

In the event of effective methods of dissemination
of the nasal irritant, a large proportion of the more severe type of case must be expected. Cases exhibiting respiratory embarrassment or motor disturbance should be retained for observation and, if necessary, for evacuation to Hospital. Should it happen that a Post be besieged by agonised victims of arsenical irritants, the assistance of the police or military should be requested, and our authorities should have arrangements made in anticipation of such an eventuality.

BY CASUALTY CLEARING HOSPITALS:

The Casualty Clearing Hospital will not be called upon in the normal course to handle any uncomplicated nasal irritant cases except such as reach them from First Aid Posts. Medical staff are competent to deal with any of the more serious effects produced by this gas. It would be an advantage, however, if their attention were drawn to these by a short memorandum outlining the principal findings recorded in the medical literature of the last war, especially with regard to motor and sensory sequelae.
TWO CLEANING PROCEDURES

SUGGESTED BY THE WRITER

A. FOR AIR RAID CASUALTY SERVICE

B. FOR CASUALTY CLEARING HOSPITALS
Duties of Personnel at the Cleansing Sections of First Aid Posts or at the additional Cleansing Centres established for the purpose of cleansing gas contaminated members of the public.

1. For administrative and operational purposes gas contaminated cases have been classified into two groups, viz: 

   Group A - Unwounded and slightly wounded (walking) cases.

   Group B - Seriously wounded (stretcher) cases.

Group A cases are dealt with at First Aid Posts and additional cleansing centres. Group B at Hospitals. In a few cases posts and centres have been specially adapted to deal with stretchers as well as walking contaminated cases. There may be other exceptional circumstances where the personnel of posts and centres may be called upon to deal with stretcher contaminated cases and brief notes are therefore given at the end of this paper of the methods to be adopted in dealing with these cases.

2. Normal Procedure at First Aid Posts and Cleansing Centres.

Section. Open Shed.

<table>
<thead>
<tr>
<th>Number of Personnel</th>
<th>Equipment</th>
<th>Protective Clothing of Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medical Officer</td>
<td>Bleach powder</td>
<td>Full suit of light protective clothing</td>
</tr>
<tr>
<td>and 1/4 to 8 others</td>
<td>Bleach paste</td>
<td>including civilian duty respirator</td>
</tr>
<tr>
<td>(depending on condition of casualties)</td>
<td>No. 2 ointment</td>
<td>and steel helmet.</td>
</tr>
<tr>
<td></td>
<td>Hydrogen peroxide</td>
<td>Underclothing</td>
</tr>
<tr>
<td></td>
<td>Bass brooms</td>
<td>including socks.</td>
</tr>
<tr>
<td></td>
<td>Long handled brushes</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bins for outer garments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bleach Trays</td>
<td></td>
</tr>
<tr>
<td></td>
<td>String bags for outer garments</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Metal numbered tallies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bags, for valuables</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Scissors, 7 inch</td>
<td></td>
</tr>
</tbody>
</table>
PROCEDURE IN OPEN SHED.

1. All outer clothing whether contaminated or not should be removed in the open shed before casualties are allowed to proceed to the undressing room.

2. Personnel wearing light protective anti-gas clothing and respirators will supervise the removal of the outer clothing. Injured cases should receive every assistance but uninjured should be able to undress themselves.

3. Boots should be decontaminated in the bleach tray before they are removed.

4. Each person will receive a serial number which should be attached to his person.

5. Discarded outer clothing should be placed in a sack or bag marked with the serial number of the owner.

6. These sacks of outer clothing should be placed in the metal or other containers provided. After decontamination the clothing will be returned to the owner.

7. Respirators unless contaminated with liquid vesicants will accompany the cases through the post.

8. Personnel in the open shed are responsible for seeing that no clothing, respirators or other equipment contaminated by liquid vesicants are taken into the cleansing centre.

9. Personal papers, valuables, etc., placed in a suitable bag, should be carried by the owners into the cleansing room.

Air Lock - for use at night especially in the event of heavily contaminated wounded arriving at the post - to prevent vapour from grossly contaminating outer clothing in the open shed reaching the undressing room where personnel and patients are unprotected.
Section. Undressing Room.

<table>
<thead>
<tr>
<th>Number of Personnel</th>
<th>Equipment</th>
<th>Protective Clothing of Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-4 (depending on condition of casualties)</td>
<td>Bags for under-clothing</td>
<td>C.D. Respirators (for emergency)</td>
</tr>
<tr>
<td></td>
<td>Bins for under-clothing</td>
<td>Eye shields</td>
</tr>
<tr>
<td></td>
<td>Forms with oil-skin covers</td>
<td>Waterproof aprons</td>
</tr>
<tr>
<td></td>
<td>Clasp Knives</td>
<td>Rubber boots</td>
</tr>
<tr>
<td></td>
<td>Scissors, 7 inch</td>
<td>Socks, underclothing etc.</td>
</tr>
<tr>
<td></td>
<td>Metal numbered tallies</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Screens</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eye irrigators</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Eye lotion</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bleach paste</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 2 ointment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hydrogen Peroxide</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dettol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Morphia in solution and hypodermic syringe and needle</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cotton wool</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bandages</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dressing basins.</td>
<td></td>
</tr>
</tbody>
</table>

PROCEDURE IN UNDRESSING ROOM.

1. If there is any suspicion that the patient has had a drop of liquid vesicant in the eyes, they should be irrigated with 200 c.c's of warm water. If the eyes have been douchèd prior to the patient's admission to the post or if attention has been delayed until redness of the eyes has already appeared, irrigation should be omitted and instead a few drops of a 2.5 per cent Solution of Albucid Soluble should be instilled into the eyes.

2. Any hair seen to be contaminated with liquid gas, should be cut away and anti-gas ointment rubbed into the scalp.

3. All underclothing should be removed, placed in a net bag or sack marked with the owner's serial number and deposited in the container provided.
4. Uncontaminated respirators similarly marked are taken to the dressing room to be collected by the owner after the completion of the cleansing process. Valuables, private papers etc., are carried by the owner to the washing room.

5. Personnel working in the undressing room should use No. 2 ointment to cleanse their hands if they suspect contamination of liquid vesicants. (If rubber gloves are worn they should be washed in weak bleach and water and then water. This will destroy liquid mustard gas on the gloves before it penetrates the rubber.)

6. Great care must be taken to prevent bleach cream being carried to the eyes during irrigation.

7. Personnel should themselves wear eye shields in the undressing room.

Section. Washing Room.

<table>
<thead>
<tr>
<th>Number of Personnel</th>
<th>Equipment</th>
<th>Protective Clothing of Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 (+ 2 per wounded case)</td>
<td>Soap, Brushes, Towels</td>
<td>As for Undressing Room</td>
</tr>
</tbody>
</table>

PROCEDURE IN WASHING ROOM.

1. Showers are normally in batteries of two. The first is used to wet the skin thoroughly. Between the two showers is a pail of liquid soap and here the skin is covered with a good lather. The second shower is used to wash the soap off the skin.

2. If necessary one spray can be made to serve both for wetting the skin and for removing the soap.

3. If it should happen that contaminated persons cannot receive attention until reddening of the skin or blisters have already appeared they should not be washed with soap and water. In such cases the affected skin should be carefully treated with antiseptic soap solution such as "Dettol".
4. After washing and drying, the cleansing process is complete and the person may now pass to the dressing room to receive an issue of clothing and any surgical attention that may be required.

**Section. Dressing Room.**

<table>
<thead>
<tr>
<th>Number of Personnel</th>
<th>Equipment</th>
<th>Protective Clothing of Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.</td>
<td>Baskets for soiled towels</td>
<td>Normal equipment of First Aid Post personnel, except eye shields and gloves for personnel treating valuables.</td>
</tr>
<tr>
<td></td>
<td>Cupboard, clothing</td>
<td></td>
</tr>
<tr>
<td></td>
<td>No. 2 ointment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>H₂O₂</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Dettol</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Albucid Soluble</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Bleach Cream</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Taraffin</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Trays for valuables.</td>
<td></td>
</tr>
</tbody>
</table>

**PROCEDURE IN DRESSING ROOM.**

1. Clothing is issued - issue of respirator if necessary.

2. The admission form (name, address etc.) for each person is completed.

3. The casualty is, if necessary, admitted to the post for treatment, or for rest and refreshment.

4. If inflamed eyes have not been previously treated albucid soluble solution may now be instilled and blistered skin treated with "Dettol".

5. Valuables are decontaminated.

3. Decontamination of persons without use of showers.

The recent re-assessment of the facilities which should be provided in each local authority area for the cleansing of gas contaminated members of the public was based on the anticipated numbers of persons who would be affected. Apart from a substantial increase in the number of sprays, provision has been, or is
being made, for a reserve warm water supply to be available, in the event of the main supply being cut off. This reserve should normally provide for one hour's supply. Where this is inadequate or where very large numbers have to be dealt with at the same time it will be necessary to depart from the usual routine. This would also apply where the patient's surgical condition would be impaired by the complete removal of clothing and the use of sprays. The procedure which should be adopted in these circumstances is as follows:

(a) The procedure in the Open Shed is the same as Normal Procedure in 2.

(b) In the case of wounded persons it must be carried out quickly in order to avoid increased shock, and the patient taken to the undressing-room with the minimum of delay.

(c) Here, if there is any suspicion that the patient has had a drop of liquid vesicants in the eyes they should be irrigated with 200 c.c's of warm water, if his general condition allows. This should take precedence over cleansing of the skin. If the eyes have been douched previously or if decontamination has been delayed until redness of the eyes has already appeared a few drops of 2.5 per cent. albucid soluble should be instilled into the eyes.

(d) Any article of clothing visibly contaminated with liquid vesicant should be cut off. Blankets if similarly contaminated should be changed. The skin areas underneath heavily contaminated clothing and any skin visibly splashed with vesicants should be rubbed with anti-gas ointment, (No. 2 if available).

(e) Any hair seen to be contaminated with liquid gas should be cut away and anti-gas ointment (No. 2) rubbed into the scalp.

(f) If it should happen that contaminated wounded cannot receive surgical attention until reddening of the skin or blisters have already appeared, anti-gas ointment should not be applied but the affected skin should be carefully washed with an antiseptic soap solution such as "Dettol" 20 per cent.

(g) The above procedures should be carried out quickly in order to avoid increased shock and patients after receiving the above treatment should be
covered with blankets. After these measures have been carried out it is safe to take the patient to the treatment room of the post to await attention.

4. **Stretcher-contaminated casualties.**

As stated previously seriously injured contaminated cases will be taken direct to hospital but in exceptional circumstances, e.g., distance from hospital, the staffs of first aid posts and cleansing centres may be required to treat such casualties and procedure should be as follows:

(a) **Persons suffering from a severe injury, such as haemorrhage or compound fractures, etc.** If life is to be saved, will not have been decontaminated on the spot but will have been transported to the Post without waste of time. No attempt should be made to put such serious cases with grave injury and profound shock through drastic decontamination measures. Even the complete removal of outer clothing may be enough to decide the issue between life and death.

(b) In such cases it will be impracticable to do more than the minimum of cleansing before admitting the casualty to the treatment room of the Post, although obviously contaminated hair and outer clothing should be cut away. The risk due to residual gas contamination is trivial compared with that due to the injury.

(c) In the treatment room of post, the eyes should be treated as described above (Undressing Room 1).

(d) **Any residue of anti-gas ointment - particularly in the vicinity of the wound, should be removed with ether.** This treatment will also remove the last traces of vesicants from the skin.

(e) If there is any reason to suppose that liquid mustard has actually got inside a wound, irrigation with sodium hypochlorite is recommended.

(f) If it is known that the contaminant is Lewisite, hydrogen peroxide should be used in place of sodium hypochlorite solution. Excision of the wound is particularly desirable in the case of Lewisite contamination.

(g) If the medical officer sees or smells mustard gas
in a wound he should frequently rinse his rubber gloves in weak bleach and water followed by water alone. This will destroy any liquid mustard gas on the gloves before it penetrates the rubber.

(h) Personnel handling such cases in the treatment room should wear eye shields.
CLEANSING CENTRES OF CASUALTY CLEARING HOSPITALS.

Emergency Medical Service

Duties of Personnel in Cleansing Centre of Reception or Casualty Clearing Hospital.

It is the responsibility of the "receiving room" personnel to see that contaminated wounded are not admitted to a ward or operating theatre with liquid vesicants on their clothing or skin.

Note: It is impossible to draw up precise instructions covering all cases, but the general lines on which treatment of contaminated wounded may be carried out and the sequence of such treatment may be stated.

Normal Procedure at Cleansing Section of Reception Hospitals.

1. Decontamination with use of the spray bath.

The full procedure now to be described should on no account be carried out in the case of severe surgical injuries and should not be allowed to cause delay in the handling of casualties.

Section. Outer Room.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>One Medical Officer, one Sister and two trained Nurses per table.</td>
<td>Bins for contaminated clothing String bags Metal numbered tallies Bags for valuables Scissors 7 in. Screens Bass Brooms Bleach Cream No. 2 Ointment H₂O₂ (20 vol.) Liquor Antisepticus Eye irrigators Eye lotion Morphia in Solution Hypodermic syringe and needles.</td>
<td>Light protective clothing - full suit including respirator, gloves and boots.</td>
</tr>
</tbody>
</table>
PROCEDURE IN OUTER ROOM.

1. Wounded persons who are also contaminated with liquid vesicants, but who have had initial cleansing treatment at the incident by first aid parties or others, should on arrival at hospital be taken straight from the ambulance to the washing room of the hospital cleansing section.

2. At night it may not be possible for first aid parties to see if casualties are also contaminated and the responsibility for their proper cleansing will then devolve on the cleansing personnel of the cleansing centres.

3. Such contaminated persons should, if necessary, be brought into the outer room of the hospital decontamination centre and any contaminated clothing removed. The "receiving room" personnel, wearing oilskins or rubber aprons and medium weight rubber gloves, should cut off the clothing if necessary and the case should then be taken to the washing room. It is important to avoid delay in the outer room.

4. Contaminated clothing, adequately identified by serial numbers or in some similar way, should be collected in the metal or other containers provided for the purpose.

5. Respirators, unless visibly contaminated with liquid vesicants, should accompany the cases to the wards.

Air Lock - for use especially at night in the event of contaminated wounded arriving at the hospital - to prevent contaminated clothing in the outer room reaching the washing room.

Section. Washing Room.

<table>
<thead>
<tr>
<th>Number of Personnel</th>
<th>Equipment</th>
<th>Clothing of Personnel</th>
</tr>
</thead>
<tbody>
<tr>
<td>One Sister, two trained Nurses per table</td>
<td>The same as in Outer Room. Contaminated cases may be brought from ambulance to the room. i.e. those already partially treated by First Aid Parties, Major Surgical cases etc.</td>
<td>Respirators</td>
</tr>
</tbody>
</table>
PROCEDURE IN WASHING ROOM.

1. The procedure here is the same for all cases whether or not they have received any previous anti-gas treatment.

2. If there is any suspicion that the patient has had a drop of liquid vesicant in the eyes they should be irrigated with 200 c.c.s. of warm water if the general condition allows. This should take precedence over removal of the clothing and washing of the skin.

3. If the eyes have been douched by first aid parties or if attention has been delayed until redness of the eyes has already appeared irrigation should be omitted and instead a few drops of a 2.5 per cent solution of a Albuscid Soluble should be instilled into the eyes.

4. Any hair seen to be contaminated with liquid gas should be cut away and anti-gas (No. 2) rubbed into the scalp.

5. The patient's clothing should now be removed and his skin should be thoroughly washed, using a spray of warm water and soap. It should not be necessary to remove dressings or splints. The changing of contaminated dressings and the cleansing of the contaminated wounds should not be attempted during the cleansing process.

6. If reddening of the skin, or blisters, have already appeared, the affected areas should be carefully washed with anti-septic soap solution such as "Dettol". (Liquor Antisepticus).

7. Patients after receiving the above treatment should be covered with blankets.

8. The above procedure must be carried out quickly in order to avoid increased shock.

9. The handles and other visibly contaminated surfaces of stretchers should be decontaminated with bleach paste.

10. It is now safe to take the patient to the operating theatre or to await attention in a "shock ward".
2. Decontamination without use of the spray bath.

This procedure should be adopted - (a) where the patient's surgical condition would be impaired by the handling necessary in the complete removal of the clothing and washing process; (b) if large numbers of cases have to be dealt with; and (c) in the event of the failure of water supply.

It is the responsibility of the first aid party, and certain other casualty personnel, if there is any suspicion that the patient has had a drop of liquid vesicant in the eyes, to douche them with water and to rub anti-gas ointment (No. 2 if available) on to the skin of the patient if it is visibly contaminated, and also to remove clothing which is similarly contaminated. Should the person be suffering from a severe injury this injury must, of course, be attended to first. These persons on arrival at hospital should be taken straight from the ambulance to the washing room of the hospital cleansing centre.

Contaminated persons who have not been cleansed by first aid parties may, if necessary, be brought into the outer room of the hospital decontamination section and any contaminated clothing cut off. This will be done by the "receiving room" personnel, wearing oilskins or rubber aprons and medium weight rubber gloves. It is important to avoid delay in this outer room which would increase the state of shock. The patient must be taken to the washing room at the earliest possible moment.

The procedure in the washing room is the same for all cases whether or not they have received any previous anti-gas treatment.

If there is any suspicion that the patient has had a drop of liquid vesicant in the eyes, they should be irrigated with 200 c.c.s. of warm water if his general condition allows. This should take precedence over cleansing of the skin. If the eyes have been douched prior to admission or if attention has been delayed until redness of the eyes has already appeared, irrigation should be omitted and instead a few drops of a 2.5 per cent solution of Alburoid Soluble should be instilled into the eyes.

Any clothing contaminated visibly with liquid gas should be cut off. Blankets if similarly contaminated should be changed. The skin areas underneath heavily contaminated clothing and any skin visibly splashed with
vesicants should be rubbed with anti-gas ointment (No. 2 if available).

Any hair seen to be contaminated with liquid gas should be cut away and anti-gas ointment (No. 2) rubbed into the scalp.

If it should happen that contaminated wounded cannot receive surgical attention till reddening of the skin, or blisters, have already appeared, anti-gas ointment should not be applied but the affected skin should be carefully washed with anti-septic soapy solution such as Dettol (Liquor Antisepticus).

Patients after receiving the above treatment should be covered with blankets.

The above procedure should be carried out quickly in order to avoid increased shock.

After these measures have been carried out it is safe to take the patient to an operating theatre or to a "shock ward" to await attention.

Decontamination of Casualties with grave injuries and profound shock.

1. Persons suffering from a severe injury, such as haemorrhage, compound fracture, etc., if life is to be saved, will not have been decontaminated on the spot but will have been transported to hospital without waste of time.

2. If the injury is grave and the condition of shock profound, undue handling, e.g. over-drastic cleansing treatment, even the complete removal of the outer clothing, at the hospital, may be enough to decide the issue between life and death. In such cases it is essential that no more than the minimum of cleansing be attempted before removing the casualty to the operating theatre or "shock ward", although any obviously contaminated hair or outer clothing should be cut away. The risk due to residual gas-contamination is trivial compared with that due to the injury.

Directions to the Surgical Personnel.

1. In the operating theatre any residue of anti-gas ointment - particularly if in the vicinity of the wound, should be removed with ether. This treatment will also remove the last traces of vesicants from the skin.

2. If there is any reason to suspect that liquid
mustard gas has actually got inside a wound, irrigation with Busol or Dakin's solution (or sodium hypochlorite) should be carried out.

3. If it is suspected that the contaminant is Lewisite, hydrogen peroxide should be used in place of Busol or Dakin's or sodium hypochlorite solution, and, if circumstances permit, the edges of the wound should be excised.

4. If the operating surgeon sees or smells mustard gas in a wound, he should frequently rinse his rubber surgical gloves in weak bleach and water followed by water alone. This will destroy any liquid gas on the gloves before it can penetrate the rubber and is the only precaution he need take for his own safety.
A.R.P. MEDICAL ANTI-GAS TRAINING
CHAPTER IV.

A.R.P. MEDICAL ANTI-GAS TRAINING.

This Chapter is intended to review very briefly the whole field of training of the Civil Defence Services. The first part of the chapter will deal with the specialised medical anti-gas training of the Medical Profession, doctors, nurses etc., the second part with the training of the A.R.P. Services in general and of the Casualty Services in particular.

MEDICAL ANTI-GAS TRAINING
OF THE MEDICAL PROFESSION.

In Chapter I has been described a SCHEME OF INSTRUCTION for the Medical Profession, doctors, dentists, veterinary surgeons, medical students and nurses, launched by the Home Office, by arrangement with the British Medical Association, in 1936. At that time sixteen medical practitioners, later increased to some thirty, were appointed by the Secretary of State and trained as Medical Anti-gas Instructors. The scheme operated until the commencement of the war in September 1939. Its suspension was not due entirely to the war, rather the war offered the Ministry of Home Security convenient escape from considerable criticism which had for some time been directed against the scheme by the Ministry
of Health. By this time, in any case, the medical anti-gas training of the profession had passed to the Ministry of Health in England and to the Department of Health in Scotland. Neither body took steps to continue the Home Office Scheme and so this instruction came to a stop.

During the next eighteen months the training of the medical profession remained in abeyance except that in Scotland Professor Lelean in Edinburgh University and the writer in the Universities of Aberdeen and Dundee and in Edinburgh Colleges continued the instruction of medical students. By the gradual changing of hospital staffs with the admission of nurses who had no anti-gas training, the effect of the teaching work done in the hospitals during 1936-39 was practically lost in these eighteen months.

With the permission of the Department of Health and the co-operation of the Scottish Branch of the British Medical Association, early in 1941 the writer gave a series of three lectures to Edinburgh doctors on "Recent Advances made in the Medical Treatment of Gas Casualties". These proved popular, and with the further support of the British Medical Association, a fuller course extending to seven lectures was given in the four centres of Edinburgh, Dundee, Aberdeen and
Glasgow. In these lectures the writer had the co-operation of the District Gas Advisers and of Major Scott R.A.M.C., research worker at the Chemical Research Department of Forton and Edinburgh. The success of this training compelled the Department to consider proposals made by the writer for the training of Doctors and Sisters as MEDICAL ANTI-GAS INSTRUCTORS in order that the medical training of hospital staffs, medical and nursing, throughout Scotland might be overtaken. The proposals were agreed to, and the writer was asked to arrange the courses of instruction which he had suggested. Two COURSES were held in Glasgow, one for Doctors and one for Sister Tutors, and two similar courses in Edinburgh. The SYLLABUS is given in the Appendix. (III).

Those who attended were selected from the more important Scottish medical institutions. The course lasted five days and was followed by a written and practical examination. The result was the qualifying of some thirty-five doctors and thirty-five sister tutors as Medical Anti-Gas Instructors.

To these Instructors was assigned the responsibility of the training of hospital medical and nursing staffs in theoretical and practical anti-gas measures, in preventive, first aid and medical treatment of gas casualties, in procedure in the Cleansing Section of
the hospital and in the supervision of respirators - fitting, wearing, repairing, drill etc. - of medical and domestic staff alike. In addition, they would form the link in their Institutions with the corresponding District Gas Specialist. It was hoped that, as their other duties permitted, they would assist in the training of the staffs of satellite and other local hospitals in their respective areas.

The efficient and continuous operation of this programme of anti-gas instruction will depend largely on the encouragement given by the Department of Health to its trained Medical Instructors. Some of these, on returning to their posts after qualification, showed a marked keenness in attempting to carry out the programme which had been laid before them. In one large hospital the beginning was made on the respirators of the nursing staff when it was found that two thirds required repairing or were not of the right size.

During his recent tour of Ulster the writer was requested by the Government of NORTHERN IRELAND to carry out similar courses of instruction in Belfast. This has resulted in a sufficient number of medical and nursing Anti-Gas Instructors to cover the staffs of all medical institutions. The valuable co-operation of Prof. Noah Morris, Major Scott and the Senior
Gas Adviser in Northern Ireland, Dr. Honeyman, was secured, the first two making journeys to Ireland at great inconvenience to themselves. Northern Ireland has thus a programme of Medical Anti-Gas Training similar to that which has been described for Scotland.

In ENGLAND the Ministry of Health, whose opposition to the original Home Office Medical Anti-Gas Scheme was mainly responsible for its termination in 1939, allowed, in the same way as the Department of Health in Scotland, the anti-gas training of doctors and nurses to remain suspended for the first eighteen months of the war. It was only in 1941 it undertook a restricted Scheme of Instruction to be carried out by a very small panel of Medical Gas Specialists who must, as a necessary qualification, have had experience in the clinical treatment of gas cases in the last war. The entire anti-gas instruction in this scheme consisted of one session of one or two lectures strictly limited to purely clinical matters. The Ministry's objection to the Home Office Course had been largely on account of non-clinical instruction, that concerning personal protection, decontamination etc. In their new scheme, therefore, such subjects were omitted. It was clearly shown to be considered quite unnecessary that doctors be asked to concern themselves with what was looked on as non-medical anti-
gas matters. A similar scheme of CLINICAL INSTRUCTION is in operation in SCOTLAND. Two medical specialists who offered their services to the Department of Health have visited most of the hospitals in Scotland lecturing on purely clinical subjects. This clinical instruction has been found complementary, in Scotland, to the training by the more recently trained Medical Anti-Gas Instructors, though of the two it is, in the writer's opinion, the less essential and urgent.

On the subject of the ANTI-GAS TRAINING OF THE MEDICAL OFFICER the Medical History of the War gives the following opinion, "The incident of gas casualties in the field was very closely dependent on the effectiveness of the measures devised and used for protection against warfare gases. It was of the greatest importance that every Medical Officer should understand thoroughly the use and true value of any protective appliance and the significance of the various defensive measures against gas, for he had perhaps a better chance than anyone else of identifying any real failure in these defensive measures, owing to his opportunities for questioning the casualties and studying their clinical symptoms. The nature of these symptoms might suggest the use by the enemy of some new poisonous substance capable perhaps of penetrating the respirator, or of so subtle a character
as to defeat the measures previously found sufficient for protection. By questioning the casualties, as to the reason why they were gassed, a Medical Officer might be convinced of the existence of flaws in the instructions regarding defence against gas that could be remedied. While his primary duty is the treatment of his cases, he should never forget the overwhelming importance of effective preventive measures in the case of gas warfare." If this was necessary on the battle-field surely it is much more so in a city when the battle-field may be transferred without any warning to the very institution in which the doctor is working. How valuable to a doctor under such circumstances the knowledge which will enable him to supervise the correct use of the anti-gas measures necessary for the protection of himself, his staff and his patients! In practice it will be required of him to know also how to handle the incendiary bomb and tackle commencing fires, though, of course, instruction in incendiary bombs and high-explosive bombs do not form part of medical anti-gas instruction. Therefore, though the clinical instruction is itself excellent, the Ministry of Health Scheme must be regarded as inadequate by itself. It is not clinical but practical anti-gas instruction that the qualified medical man will require most. He will not find his difficulty in the treating of his patient in the quiet and peace of an ordinary
hospital ward but in taking his share efficiently in the stress and strain of the gas attack without himself, through ignorance or lack of skill, becoming an early casualty and therefore an added burden instead of a valuable unit. The fallacy of underestimating practical anti-gas training is illustrated by the Memorandum of the Ministry of Health on medical anti-gas treatment published in the British Medical Journal in May of last year. This memorandum was the joint work of the clinical team of lecturers in England already referred to, and represented a précis of the instruction considered sufficient by them for medical men. It revealed ignorance of elementary anti-gas measures which would have sealed the fate of minor A.R.P. personnel in a simple anti-gas test. For example, it stated that respirators give protection against carbon monoxide, that No. 1 Ointment can be used against lewisite, and that in order of urgency the removal of contaminated clothing should take precedence over life-saving measures in the treatment of contaminated gas casualties who were also gravely injured.

MEDICAL ANTI-GAS TRAINING
OF THE A.R.P. SERVICES.

The anti-gas training of the A.R.P. Services including the medical aspects, physiological action
of the war gases, preventive and first aid treatment of gas casualties etc., began with the Home Office A.R.P. Department and has continued with it until today. Unlike the anti-gas training of doctors and nurses, this has been continuous and since its initiation has steadily progressed to a high state of excellence.

The TRAINING BRANCH of the Ministry of Home Security is under the Director-General of Air Raid Precautions, Wing Commander E. J. Hodsoll, C.B. who is Chief Training Officer. Wing Commander Hodsoll was the Director of the initial A.R.P. Department of the Home Office and responsible for the policy which included the free issue to all of civilian respirators, the institution of the Home Office Gas Schools and the initial Anti-Gas Training Schemes for the Medical Services and the Police Force of the country. In addition to the TRAINING SPECIALISTS at Headquarters in London there is a TRAINING OFFICER attached to each Regional Commissioner's Office. Under the direction of the Director General there are two Home Office CIVILIAN ANTI-GAS SCHOOLS, and in the Regions there are REGIONAL TRAINING SCHOOLS.

The main function of the Home Office ANTI-GAS SCHOOL is the production of highly trained Anti-Gas Instructors for Scheme-Making Authorities. This ensures
the supply of adequately trained teaching personnel and uniformity of instruction throughout the country. Contact maintained between the schools and the instructors in their work is mutually advantageous. The GAS SCHOOLS also offer shorter courses of instruction on Decontamination for Medical Officers of Health, and so on.

There is a large series of A.R.P. TRAINING MANUALS, Handbooks, Memoranda, Pamphlets etc. which set out in admirable detail all that is essential in training organisation, operational control, equipment etc. etc. These are continually being brought up to date and expanded. An exception to this in the official A.R.P. literature dealing with first aid and medical treatment has already been mentioned. Although medical instruction has been in the hands of the Ministry of Health in England and the Department of Health in Scotland since 1939 neither has had the Medical A.R.P. Handbooks revised. These authorities are not only responsible for the anti-gas training of the medical profession but they are also in the character of medical advisers to the Ministry of Home Security in the medical training of the A.R.P. Services.

Throughout England the Assistant Regional Hospital Officer of the Ministry of Health, specially appointed
for the purpose in 1940, co-operates with the Regional Training Officer of the Ministry of Home Security in the training of the A.R.P. Services. In Scotland two INSPECTORS OF CASUALTY SERVICES were appointed by the Department of Health in 1940, one to co-operate with the District Office of the Ministry of Home Security in Glasgow and the other, the writer, to co-operate with the Regional Office in Edinburgh. One of their principal duties as Inspectors was to be the supervision of the medical training of the A.R.P. Services in Scotland. These Inspectors, as has already been noted, were transferred from the Ministry of Home Security where they had been employed since 1936 as Medical Anti-Gas Instructors. From 1939 until this transference took place in 1940 they had already been supervising the Medical Anti-Gas Training of the First Aid Parties of their respective areas. At the time of their formal transference to the Department an INSTRUCTION was issued by the Department in which the duties of these officers were defined. According to this Instruction HOSPITAL OFFICERS in the Districts were to be responsible for the supervision of the Medical Training of the A.R.P. Services in their Districts and the Inspectors newly appointed were to supervise this training in the capacity of deputies to the Chief Medical Officer. The scheme on paper was excellent. Actually no action was taken by the
Department beyond the issuing of the Instruction.
The two Medical Inspectors continued to operate from
the offices of the Civil Defence Commissioners.
Eventually the one in Glasgow became employed almost
entirely in non-training duties, and the Department of
Health showed little interest in the training
activities of the writer. The Hospital Officers, who
had not been consulted in the drawing up of the
Instruction, were too fully occupied with other duties
to give time or thought to training.

Following on the training of the Medical Anti-
Gas Instructors in Glasgow and Edinburgh in 1941 the
writer relinquished his appointment with the Department
in order to return to post-graduate medical work.
The vacancy caused in this way has been filled by
reviving that part of the Instruction which laid the
responsibility for training in each District on the
Hospital Officer concerned. This arrangement appears
excellent on paper, but Hospital Officers have them-
selves had no A.R.P. or anti-gas training and are
fully occupied with their existing responsibilities.
At the request of the Chief Medical Officer of the
Department, the writer, before his departure from
the Department gave Hospital Officers a few lectures on
the problems of training the Casualty Services of their
Districts. He did what he could at that time to press
on the Department the urgency of the need for a full course of instruction for Hospital Officers at one of the Home Office A.R.P. Schools to render them competent to act as expert advisers to Scheme-making Authorities. This advice has not been taken: that influential group of its officers, if trained and active in the A.R.P. cause, might prove a rather troublesome element to the Department!

Each Scheme-making Authority is responsible for the training of its A.R.P. personnel. The Heads of Services are responsible to the Emergency Committee of the Scheme-making Authority for the training of the personnel in their respective Services. Raw recruits, before being allocated to a Service, are put through basic training. But training involves much more than the instruction of the individual in the theory of his work and the routine of his duties. The various Services must be able to co-operate in action and this involves the exercising of the different Services in combination. In order to co-ordinate all these aspects of Training, Scheme-making Authorities have been authorised to appoint TRAINING OFFICERS. Under Training Officers, Instructors (C.A.G.) trained in the Home Office Anti-Gas Schools carry out the routine training of recruits and of locally trained instructors (L.A.G.S.) who in their turn assist C.A.G. instructors
in the routine training of the A.R.P. Services.

The activities of the REGIONAL TRAINING OFFICER of the Ministry in Scotland are of a supervisory character. He keeps contact with the Training Officers of the Scheme-making Authorities in his Region. All questions of training referred by them to Region are dealt with by him and this gives him great opportunity for rendering assistance to Scheme-making Authorities in their training problems. A good Regional Training Officer, and Scotland is fortunate at the moment in having one of the most efficient of the Ministry's Training Officers, has tremendous opportunities. The Scheme-making Authorities put confidence in him, welcome his activities and give him their full co-operation. Here are some of the methods being used with great success in Scotland at the present time by its Regional Training Officer. Periodic conferences of District Training Officers are held from Edinburgh to Inverness. These are attended by the Training Officers of the Scheme-making Authorities and the large industrial and commercial businesses of the corresponding area. Local problems are handled in open conference and specialists are brought from London in order that particular problems of specialised aspects of training may be discussed. A training Bulletin is circulated monthly and keeps Training
Officers up to date in Regional developments. In order to encourage training and increase efficiency in the Services personal visits are made to local areas for the purpose of giving advice and guidance to local officials on the spot regarding their local schemes. The Regional Training Officer is also the Ministry's official responsible in exercises in which use is made of tear or other war gases, whether for the training of the A.R.P. Services or in public tests. Some of the heaviest work that falls to the Regional Training Officer concerns co-operation and co-ordination between Districts, and between Civil Defence and the Fighting Services, in the larger combined and regional exercises now an important part of Civil Defence training.

However efficient and enthusiastic a Regional Training Officer may be, he cannot be expected to understand the special medical problems of the Casualty Services. In Scotland the Regional Training Officer of the Ministry has no corresponding Medical Training Officer with whom to co-operate in the training of the A.R.P. Services. It would be of great value to Civil Defence in Scotland should the Department of Health appoint a Medical Officer for this purpose charged with all the medical aspects of A.R.P. training.
TRAINING falls naturally into three main classes, Individual, Team and Combined. HIGHER STAFF TRAINING, for instruction in "the handling and solving of the wider problems of Civil Defence" concerns the staffs of Regional and District Commissioners, Local Authority Controllers and Heads of Services. It is carried out under the direction of the Ministry of Home Security and other government departments. It includes exercises in the reinforcement of one area from another and the holding of large-scale tests.

INDIVIDUAL TRAINING is the basic training of every A.R.P. worker and is the standard for the new recruit. It is given in two stages. The first stage is limited to an outline of A.R.P. organisation, incendiary bomb control, protection against high-explosive bombs, anti-gas training and first aid, and the length of syllabus is 4½ hours. The second stage is intended to raise the standard of knowledge and to give technical training in the work of the Service to which the recruit has been transferred on the completion of his basic training, e.g. to give First Aid Party Workers training in first aid for injured and gas cases. The personnel of all the Casualty Services are given full courses in First Aid and Anti-Gas Training.
TEAM TRAINING teaches individuals to work together as members of a unit. A First Aid Party is essentially a team of four men acting under the leadership of "No. 1" of the team. A First Aid Party is taught to work as itself an individual unit when in a larger team composed of several First Aid Parties. Team training also teaches them how to co-operate as individual units of a Casualty Unit Team which includes Ambulances and Mobile Posts as well as First Aid Parties. In the case of First Aid Post personnel, separate teams are first taught in their own special duties, likewise the Cleansing Section team, the Reception Room team, Treating Room team and Rest Room team, each in its own work; and then the whole trained to act as one large team.

COMBINED TRAINING. In this, all the A.R.P. Services are taught to work together in efficient co-operation. This prepares them for the day when it may be necessary for them to take their part alongside each other in action. Though success in combined training is largely due to proficiency in team work, yet a team can be very efficient as such and fail in combined work with other different A.R.P. Services. Combined training is the most exacting stage of training both from the aspect of the promoters and of the Services involved.
Individual instruction goes on continuously by means of revision through lectures and practical work. It is stimulated by competitions, by talks' schemes and in other ways. Team training provides a most useful method for testing and improving the efficiency of the individual in every direction. In the Casualty Services it is the practice of First Aid Posts to have fairly large-scale Post tests weekly. This continuity of individual and team training is all the more necessary as fresh recruits are being constantly brought in to replace trained personnel called up for national service. Combined training on a small scale, involving a limited number of Services in a restricted area, can be carried out without any great difficulty as no great effort of production is involved. On the other hand, large-scale combined exercises, involving the calling out of the full strength of the A.R.P. Services to deal with imaginary destruction, fires, gas and casualties, cannot be undertaken lightly. These are prepared by the local Training Officer in co-operation with the Heads of the respective A.R.P. Services and with reference to Region. Complex exercises of this type have been held on many occasions in all the Scheme-making Authorities' areas in Scotland. A combined exercise may take the form of Reinforcements Messages are sent from Region through District to Control Centre, Report Centre and the Services. The
units called out in this way may be stopped on the outskirts of the official rendezvous and there inspected, or perhaps allowed to proceed to the distant destination and timed and inspected on arrival there. Again "paper exercises" to test out communications are held for the training of the staffs of District, Control and Report Centres.

FIRST AID PARTIES: TRAINING.

All over Scotland the work of First Aid Parties in combined exercises has been uniformly good on the surgical side. They have shown commendable skill in diagnosing and treating the imaginary surgical casualty, but wherever exercises have included gas incidents, the performance of the First Aid Parties has been disappointing. This criticism applies also to the other A.R.P. Services involved in incidents complicated by gas. Umpires' Reports invariably draw attention to the lack of anti-gas understanding shown by all Services operating at gas incidents, with confusion resulting. Several factors may help to explain this weakness. In the first place it must be recognised that it is very difficult to produce an artificial gas incident and even more difficult for personnel to visualise the imaginary situation. Secondly, the mistake has invariably been made of staging gas incidents which are of a complicated
character beyond the capabilities of the personnel, who have not been trained by easy stages through simplified exercises. Thirdly, those taking part have received limited benefit from the combined gas exercises in which they have previously participated, because mistakes and the lessons to be learned therefrom have seldom been discussed with them by persons competent to do so, as would be Medical Anti-Gas Instructors. Much of what is taught in A.R.P. Handbooks Nos. 2 and 3 is out of date. At the present time the Ministry of Home Security has in hand a Memorandum containing directions for all Training Officers in the more efficient use of the gas incident in combined training. While helpful this does not speak with enough authority or detail on the medical anti-gas problem.

FIRST AID POSTS: TRAINING.

The work of the personnel of the Cleansing Sections of First Aid Posts has been no less disappointing than that of First Aid Parties in gas incidents, but in the case of personnel of Posts there is the additional consideration of the Post lay-out, which in many instances is faulty. There are Posts which cannot function efficiently because of their construction. Some could not be used in actual practice because they would immediately become filled with
lethal concentrations of gas vapour; others would permit the passage of only very small numbers of contaminated casualties; many cannot admit stretchers. The buildings chosen are often unsuited to the purpose. Throughout the Posts of Scotland there is a lack of uniformity in gas cleansing procedure which has been inevitable in the absence of guidance therein from the Central Authority between 1938 and 1941. In many combined exercises the writer has witnessed a complete breakdown in the handling of casualties through Cleansing Centres due obviously to complicated and often incorrect procedure impossible for the personnel to carry out.

CASUALTY CLEARING HOSPITALS: TRAINING.

In the larger combined exercises the Civil Defence Medical Services are brought into operation from First Aid Party unit to First Aid Post, Casualty Clearing Hospital and sometimes beyond. Stretcher contaminated cases brought to Casualty Clearing Hospitals are put through the full cleansing procedure before being admitted. It is not intended to discuss here the Cleansing Sections of Casualty Clearing Hospitals or the procedure adopted for the cleansing of contaminated cases. This subject has already been dealt with critically in Chapter III.
An example is appended of a typical A.R.P. COMBINED EXERCISE on a small scale. Before the commencement Umpires are placed at Control and Report Centres, Depots and Incidents throughout the area. Copies of the forms used by the writer for medical umpires are attached to the copy of the exercise. As soon as possible after the conclusion of the exercise, and not later than the second or third day, a "post-mortem" is held on the exercise. Umpires are called on to give their reports and point out the lessons to be learned. Such a brief and limited post-mortem is, of course, not an altogether satisfactory conclusion and much of the value of the exercise is lost. None the less, and admitting its unavoidable limitations, this method of training has established itself as the most valuable available to us.

THE RESPIRATOR AND PROTECTIVE CLOTHING: TRAINING.

All casualty personnel required to handle contaminated casualties are provided with a suit of light anti-gas clothing. Those who operate in the streets, such as the First Aid Party, are provided with general service respirators, and others with civilian duty respirators. The anti-gas clothing consists of rubber boots reaching almost to the knees, trousers, jacket, anti-gas gloves and respirator, and attached to the steel helmet the anti-gas curtain. Before this
clothing can be adjusted the personal clothing and underclothing must be removed. Underclothing which has been issued for the purpose is worn under the anti-gas clothing. When decontamination of the personnel is necessary, the suit of protective clothing, the underclothing, the respirator and all contaminated equipment will be discarded and the dressing room of the Personnel Cleansing Depot will be reached in a naked state. It will thus be necessary for personnel to have private outer-and underclothing and a new respirator in the Personnel Cleansing Depot. The contaminated clothing which has been discarded will be decontaminated by boiling before used another time. Suits may stand four to six boilings. What is necessary for the cleansing of the personnel of the Casualty Services is also necessary for the personnel of all the other Services. In combined exercises no attempt has yet been made to carry out such detail as this. If the simpler details are proving beyond the present state of efficiency of our Services it would be unhelpful to attempt the inclusion of greater tests; but the fact remains that, though they have never been tried out, they would be essential in action. Is it not possible that these present arrangements are too elaborate and difficult ever to stand up to the demands of raiding? Do these complicated anti-gas precautions not require simplifi-
cation? An attempt to answer this will be made in Chapter VI.

CHEMICAL RESEARCH CENTRE, PORTON.

This national centre for Research is under the Ministry of Supply. Here both offensive and defensive measures are continually under investigation. From Porton came the civilian respirator, the baby respirator, the protective helmet and improvements in the other types of respirators. The war gases are dealt with in its Physiological Section, experiments being made on man as well as on animals. Soldiers who volunteer as experimental subjects remain at the Station for one week and are rewarded by seven days' leave. Impregnated clothing used by workers in factories engaged in gas production is tested and controlled from Porton. There is close liaison between the Research Centre and the medical staffs of these factories in the treatment of cases of accidental gas poisoning. Research work is, also, performed at other centres. In Edinburgh notable research on the action of Mustard Gas and Lewisite on Eyes and the effects of Albucid Soluble and "D.T.M." in treatment etc. has been carried out. In 1941 a series of important advances in the treatment of gas casualties has resulted from valuable research work done in Porton. This has caused the incorporation into the anti-gas
armamentarium of the Civil Defence Medical Services of such additional therapeutic agents as Albucid Soluble in the treatment of mustard gas contamination of the eyes, Hydrogen Peroxide in the treatment of lewisite poisoning, Liquor Antisepticus and Amyl Salicylate in the first aid and early treatment of mustard gas burns of the skin, etc., and they have made possible vital simplifications in the cleansing process for mustard gas contamination of skin. It may be said that both as regards the treatment of the eye contaminated with vesicant gas and the cleansing of the more serious surgical cases, Porton has made possible revolutionary changes in procedure.

Liaison between Porton and the Ministry of Home Security is close, but liaison between Porton and the Training Branch of that Ministry, and between Porton and the Ministry of Health and Department of Health is neither close nor continuous. The Home Office Gas Schools have not yet incorporated into their teaching the results of the 1940 and 1941 work of Porton. The writer, by personal visits to Porton, was able to act as an unofficial link between Porton and Scotland and so make available in Medical Anti-Gas Instruction in Scotland the knowledge of the latest advances in treatment and procedure. Through this direct contact between Scotland and Porton the Civil
Defence Services in Scotland are now ahead of the official Home Office Anti-Gas Schools in instruction in preventive and first aid treatment for gas casualties. It hardly needs indicating, however, that unofficial contact by an individual should be replaced by adequate official liaison, and that the instruction given in the Home Office Anti-Gas Schools, together with the subject matter of A.R.P. Handbooks, should be kept in line with the advances established by Porton.
A.R.P. EXERCISE.

CITY OF

SEPTEMBER.

AT 15 HOURS THREE ENEMY PLANES ARE ATTACKING WITH HIGH EXPLOSIVE AND INCENDIARY BOMBS GIVING RISE TO ONE SERIOUS INCIDENT.
A.R.P. EXERCISE

SKETCH PLAN OF AREA OF INCIDENTS.

H.E. = High Explosive Bomb
I.B. = Incendiary Bomb
G.B. = Gas Bomb
UN.X = Unexploded.

Wind from North
To be Roped off
DESCRIPTION OF THE PHASES A - G.

PHASE A.

Two 500 lbs. High Explosive Bombs have fallen - one on Wardens Post at No. 3 Barossa Place, and the other at junction of Rose Terrace and Barossa Place; at that point Rose Terrace is completely blocked. Damage has been done to gas and water mains, sewers and electric underground cables. There are three casualties in vicinity of crater, two slight casualties in Wardens Post, and five persons killed on pavement in front of Wardens Post.

PHASE B.

Two 500 lbs. High Explosive Bombs have fallen - one on St. John's R. C. School, Barossa Street, and one in the playground. There are about 25 injured persons in the School and the playground, and in addition there are seven trapped in the building, five persons have been killed in the playground and on the pavement at Barossa Street.

PHASE C.

A 500 lbs. High Explosive Bomb has fallen on house at No. 8 Rose Ter. on north side of the Old Academy. Seven casualties are trapped - three in the basement and four on the first floor.

Incendiary Bombs have fallen on house further north
from the Old Academy - No. 17 Rose Terrace - setting
the house on fire. There are three people overcome
by smoke in the basement.

PHASE D.

Incendiary Bombs have fallen at Atholl Crescent
and the Masonic Lodge is on fire. There are no
casualties.

PHASE E.

A Gas Bomb containing liquid Gas has fallen in
Stormont Street opposite St. John's R. C. School,
causing contamination of the roadway, pavement, and
school wall. A motor car has been contaminated.
Six persons who were injured by a H.E. Bomb which
fell at St. John's R. C. School (see Phase B) have
been splashed with liquid, besides other four persons
who are not otherwise injured. The wind is blowing
from the north.

PHASE F.

A 500 lbs. High Explosive bomb has fallen on the
north side of Barossa Place, between Barossa Street
and Stormont Street. A horse is seriously injured
by splinters.
PHASE G.

A 500 lbs. High Explosive Bomb has fallen in Barossa Street, about 10 yards from Atholl Street. It has failed to explode.

Incendiary Bombs, causing a large fire, have fallen in the rear building of the Old Academy.
There are no casualties.
**PRODUCER'S SUMMARY OF EXERCISE**

**RAID NO. 1.**

<table>
<thead>
<tr>
<th>Phase No.</th>
<th>Description</th>
<th>Units Exercised</th>
<th>Place</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.</td>
<td>An H.E. Bomb has fallen on Wardens Post at 3 Barossa Place. Another has fallen &amp; completely blocked roadway at junction of Rose Terrace and Barossa Place. Damage to Gas &amp; Water Mains, Sewers &amp; electric underground cables. 5 casualties (2 slight in Wardens post, 3 near crater) 5 people killed.</td>
<td>F.A.P. Ambulance Car for S/C R.P./W. R.P./G. R.P./E. R.P./Sewers R.P./R. Mortuary Service.</td>
<td>3 Barossa Pl. x junction of Rose Terrace with Barossa Place.</td>
</tr>
<tr>
<td>Phase No.</td>
<td>Description</td>
<td>Units Exercised</td>
<td>Place.</td>
</tr>
<tr>
<td>----------</td>
<td>------------------------------------------------------------------------------</td>
<td>-----------------</td>
<td>---------------------</td>
</tr>
<tr>
<td>D.</td>
<td>Incendiary Bombs have fallen at Atholl Crescent, Masonic Lodge on fire.</td>
<td>A.F.S.</td>
<td>Atholl Crescent.</td>
</tr>
<tr>
<td>E.</td>
<td>A Gas Bomb has fallen in Stormont St., roadway, pavement &amp; St. John's R.C. School wall are contaminated, and also a motor car. 6 casualties from H.E. Bomb which fell at the School are contaminated besides other 4 persons who are not otherwise injured. North wind.</td>
<td>F.A.F. Ambulance Decon. Squad G.I.O.</td>
<td>Stormont Street.</td>
</tr>
<tr>
<td>F.</td>
<td>An H.E. Bomb has fallen on north side of Barossa Place - between Barossa St. and Stormont Street. A horse is seriously injured by splinters.</td>
<td>N.A.R.P.A. Service.</td>
<td>North side of Barossa Place.</td>
</tr>
<tr>
<td>G.</td>
<td>An H.E. Bomb has fallen in Barossa St. about 10 yards from Atholl St. This bomb has not exploded. Incendiary Bombs causing large fire have fallen in rear building of Old Academy.</td>
<td>A.F.S.</td>
<td>Barossa St.</td>
</tr>
</tbody>
</table>
Dear Dr.

MEDICAL UMPIRES.

We are grateful to you for your willingness to co-operate as Medical Umpire in the Regional A.R.P. Exercise to be held in No. District, on ..............

The details of the Post or Incident to which you have been allocated are:

ADDRESS. ....................................................
No........ TIME ...........................
First. Aid Post .................................
Incident ............................................

Will you kindly report at the address above fully fifteen minutes before the allotted time and contact with the Chief Umpire who will be distinguished by a white band round left arm.

Your umpiring will be greatly facilitated if you can find time to examine the casualties prior to the arrival of the services. If these have not been suitably placed you should try to get this done.

Officials of the A.R.P. Services and Local Authority personnel generally have been asked to give you every assistance in their power in carrying out your duties as Official Medical Umpire.

A sheet of notes to assist you in your umpiring will be sent to you, and your report should be sent to Dr. J. Nairn Hay, Medical Inspector of Casualty Services at the above address as soon as possible after the exercise.

Please enclose with your report a statement showing the number of miles covered by you if you use your own car and the number of gallons of petrol used.

Yours sincerely,
NOTES FOR THE GUIDANCE OF MEDICAL UMPIRES

IN REPORTING ON THE WORK OF

FIRST AID PARTIES.

INDIVIDUAL TRAINING - Knowledge of First Aid and Gas shown by individual members of units, also H.E. and I.B. control.

TEAM TRAINING - The working of the Unit as a whole - particularly in the case of the First Aid Post.

COMBINED TRAINING - The co-operation of the Medical Units with other medical and non-medical units and services - particularly in the case of the First Aid Party.

FIRST AID PARTY - (Unit of four men and driver in own car - mobile).

Usually followed by a car for Sitting Cases and an ambulance for stretcher cases.


2. Are vehicles packed properly?

3. Does No. 1 of Party show correct classification of cases, i.e. are urgent cases treated first and sitting cases left to the end?

4. What action is taken to combat secondary shock?

5. Note: Splinting and bandaging of injured persons, handling of special cases, i.e. injuries to spine, brain, abdomen and chest, shock, haemorrhage, etc.

6. If any serious delay in work of First Aid Party, please report as fully as possible.

7. Are ambulances complete with stretchers and blankets?
8. Are stretchers loaded smoothly and in correct order, and driven with a view to the patients' comfort?

9. If Gas incident, please note:-
   
   (a) Is First Aid Party wearing complete protective clothing?
   
   (b) What measures are taken to minimise contamination of personnel and their vehicles and equipment?
   
   (c) What anti-gas treatment is given to cases?

10. Certification and disposal of the contaminated and uncontaminated dead.

11. First Aid given by WARDENS

   " " " RESCUE PARTY
   
   " " " OTHERS.
NOTES FOR THE GUIDANCE OF MEDICAL UMPIRES

IN REPORTING ON THE WORK OF

FIRST AID POSTS.

INDIVIDUAL TRAINING - Knowledge of First Aid and Gas shown by individual members of units, also H.E. and I.B. control.

TEAM TRAINING - The working of the Unit as a whole - particularly in the case of the First Aid Post.

COMBINED TRAINING - The co-operation of the Medical Units with other medical and non-medical units and services - particularly in the case of the First Aid Party.

FIRST AID POST

Surgical Section

1. What Staff is on duty?
2. Unloading of ambulances.
3. Replacement of stretchers and blankets, etc.
4. Is Post warm.
5. Are Hot Water bottles ready?
6. How are patients admitted and classified?
7. How are hospital cases dealt with?
8. Cause of any serious delay in arrival of or in handling.
9. Numbers arriving already dead or dying.
10. Supplies of M.P.C. 44 and 46.
11. Any reported shortage of equipment or supplies.
12. Treatment and disposal of lung irritant and Arsene Cases.

Anti-Gas Section

2. Heat and supply of water.
3. Difficulties in cleansing of wounded cases.
5. Any serious delay or lack of training of team.
6. Were any stretcher cases passed through this section?
CHAPTER V

THE ANTI-GAS TRAINING OF THE PUBLIC
CHAPTER V.

THE ANTI-GAS TRAINING OF THE PUBLIC.

That first great decision of the Air Raid Precautions Department of the Home Office, that a respirator would be issued free to every man, woman and child in the country, was a masterstroke in A.R.P. policy and psychology. In these pre-war days it was intended that CIVILIAN RESPIRATORS would be stored in central depots throughout the country and these would supply smaller depots to which the public were to have access. Upon the establishment of such a depot in a district, the public were to be advised individually as to the day and hour to visit the depot in order to be fitted with a respirator. Respirators were to be labelled with the names of their owners and hung on numbered pegs. Members of the public were to be informed, on their initial visit for the purpose of fitting, of the days and hours when they would be permitted to attend the depot to practise the wearing of their respirators under expert instruction. It was thought that this work would be the duty of the Wardens' Service. When the first civilian respirators became available, Major Blackmore had samples issued through the Home Office Medical Anti-Gas Instructors to general practitioners who had taken the Course of Medical Anti-Gas Instruction. These practitioners were asked to display the mask in their consulting rooms and to draw
the attention of patients to it as far as they found opportunity in the midst of their other work. The Emergency came upon the country before these plans could be completed and it was decided to issue respirators to the general public forthwith.

Public Information Leaflet No. 1 (Civil Defence) delivered to every householder gave preliminary advice on several anticipated situations "If War Should Come", and stressed the case of gas masks. Leaflet No. 2 was on "Your Gas Mask". These were published in July 1939. In the early months of war the emphasis in air raid precautions passed from anti-gas to anti-high-explosive and incendiary bomb, and a corresponding reaction took place in the government's official publicity policy. The Ministry of Home Security, however, continued to develop anti-gas precautions with no lessened resolution. This Ministry has appeared to regard gas warfare as an almost certain complication of the war at some time or another before its termination.

Scheme-making Authorities have always included in their routine local training in air raid precautions, the instruction of the public as well as of Services' personnel. In incendiary bomb control and in fire-fighting measures public demonstrations have been given with great effectiveness. There must be few who do
not know how to handle the stirrup-pump, and there are
civilian fire-watchers in every building. In the
anti-gas training of the general public, in contrast,
there has been no instruction which can be compared with
this in value.

One method of public anti-gas training, however,
adopted by Local Authorities is of particular interest,
namely the GAS TEST. Gas tests for the public, not
to be confused with gas exercises for the Services,
began early in 1941. The introduction of these was
due not to the Ministry of Home Security but to a few
Scheme-making Authorities who initiated them against
official discouragement. This method of training the
public, whereby an area in a city is "gassed" by a
cloud of some relatively harmless non-persistent gas,
has its own, though limited, value provided that
certain precautions are taken such as the date, time and
place being previously advertised. It can, however,
in no way replace systematic anti-gas instruction but
is commendable in that it helps to make the public gas-
minded, confident in the efficacy of the respirator and
practised in wearing it.

The public are encouraged to attend and witness
the work of the A.R.P. Services at gas incidents during
combined exercises. The performance, however, at such
exercises has invariably been so disappointing that they have been of little benefit to the onlookers.

The Ministry of Home Security and the Ministry of Information have supplied handbooks, memoranda, pamphlets, information leaflets, press notices and posters for the guidance of the public in air raid precautions. Concurrent with advice on anti-gas treatment, Protective Ointment No. 2 has been made available to the general public in jars of convenient sizes at reasonable prices. The defensive anti-gas measures recommended to the public may be summed up as follows:—

1. The respirator, which must fit properly and be in good order, should always be carried.

2. It is necessary to know how to put it on without delay, and how to wear it and walk in it with certainty and confidence.

3. Take shelter immediately on hearing the gas warning.

4. Protection against liquid gas may be had by wearing light waterproof coat and gloves and by the use of the umbrella.

Points 3 and 4 have not yet been required in action. With regard to 1 and 2 the public do not put the advice to personal application. The Government has made continuous appeal to the general public to
carry and wear their respirators. The Public have not responded; they continue to leave them at home in unopened cases. Unless there is compulsion will they ever make a practice of carrying them before the actual coming of gas attack?

In support of the public attitude, it might be argued that the mere mechanical carrying of the respirator does not weigh with the public as an anti-gas precautionary measure. It is some other aspect with regard to the respirator which requires stressing and that is, its practical value. The public should be trained to appreciate their respirator by periodic gas tests combined with regular respirator drill.

Tests of this kind would necessitate the keeping of the respirator in a state of repair. Mention has been made in a previous Chapter of a large hospital in Scotland where two-thirds of the nurses' respirators were found to be defective because of errors in size or fitting or of disrepair. School children, the only section of the population that regularly carries respirators, doing so under compulsion, have their respirators inspected from time to time. From the number of repairs and renewals required to restore these to efficiency some idea may be obtained of the condition into which the respirators of the community must have
degenerated since their issue over two years ago.

Facilities could be provided to the public for practical testing of their respirators. During the writer's visit to Northern Ireland last summer, GAS VANS visited the various districts of Belfast at times notified in advance by individual circular to householders. Respirators were examined as to fitting etc. and the public admitted to gas tests in the van. The Service personnel were hard pressed to cope with the large numbers who responded with eagerness and enthusiasm. Train the public to be gas-minded and they will be respirator-minded.

Is it advisable for the public to carry their respirators always? The War Office has relaxed this requirement for the Army, permitting the troops to leave quarters without the respirator provided they are going not more than a mile distant. A similar ruling with regard to the public would seem in keeping; and, especially in the case of school children, with great economy in replacement effort and expense.

In Northern Ireland the writer lectured to many audiences composed of members of the general public as well as of the A.R.P. Services. No attempt was made to gloss over the possible horrors of a gas attack on a
large city, yet the reaction of the public to these lectures, of which more than sixty were given throughout Ulster, was not alarm but rather reassurance. It was evident that the public are eager for reliable information and that a great deal of popular anxiety is due to the difficulty of obtaining it. The writer was impressed with the possibilities contained in this type of anti-gas instruction. Where similar lecture instruction is being undertaken by Scheme-making Authorities in Scotland it is on a very small scale, is not always reliable or helpful, and is spasmodic.

PUBLIC ANTI-GAS INSTRUCTION should consist of three parts, (a) simple but sufficient description of the types of war gases (not the individual gases), (b) essentials of personal protection and (c) practical methods available to the public for preventive and first aid anti-gas treatment. As "PUBLIC ANTI-GAS LECTURES Nos. 1, 2 and 3" they could be given regularly in a district as long as the demand continued. Following on the lectures there would be made available three DEMONSTRATIONS, one on the war gases, another on protective measures and the third on preventive and first aid measures. From much experience of this kind of work the writer is of the opinion that, to be effective, it would have to be carried out by qualified
medical men in a whole-time capacity. Doubtless much use could be made of local instructors in their own areas but the general public would not respond with sufficient enthusiasm to a scheme given wholly by the lay instructors of the A.R.P. Services.

It is by training in advance the individual members of the public in anti-gas measures and making them thoroughly gas-minded that the solution will be found to the difficult problem of the night gas raid, with preliminary bombardment by high-explosive and incendiary bombs resulting in the inevitable exposure of large numbers of the public to the immediate effects of the nasal irritants and of contamination with vesicant gases. The Intelligence Service warns us of the probability of gas attack. Government experts are unanimous that of the three methods of aerial attack, by high-explosive, incendiary and gas bomb, the last is one which need be feared only by an unprotected population: some of them go so far as to say that it is possible, theoretically, to obtain 100% protection against gas used alone. They are likewise unanimous in the view that the effects of gas attack in a population not adequately protected, and whose gas discipline is poor, would be overwhelming.

While the responsible authorities are not doing enough to educate the public in a correct attitude
towards gas, there are two types of popular figures whose influence is actively harmful: the IGNORANT ALARMIST and the INTELLECTUAL OPTIMIST. The exaggerations of the former impress only that uninformative part of the population who enjoy nothing better than the lurid pictures painted by the Sunday press. Even gases such as chlorine and the nasal irritants, which produce immediate alarming and agonising symptoms, would not be successful in demoralising a prepared public whom high-explosive and incendiary bomb failed to panic. This type of person can be dismissed, therefore, as of very temporary and limited influence.

The second type consists of people of note who are in a position to exert great influence on policy and performance in various directions. The effect of such on the development of Air Raid Precautions, especially of anti-gas precautions, will be seen below.

From the early years of his work in anti-gas instruction the writer has experienced an attitude which has taken the form of ridiculing the dangers of Gas Warfare and classing official and non-official opinions alike as "alarmist", "exaggerated" and "entirely unsupported by facts". How important this attitude has been in its bearing on the development of
our anti-gas medical arrangements can hardly be appreciated except by one who has had to contend with it and has seen how it has caused delay and modification and restriction.

In 1937 one of Scotland's largest cities decided by a majority vote of its Council to take no action in regard to air raid precautions. Another similar Authority consigned all official A.R.P. letters and circulars to its waste paper basket, without allowing discussion on them, while a neighbouring Authority adopted the procedure of leaving such documents lying on the table.

In giving his Course of Instruction, the writer found that a large number of the medical profession regarded the possibilities of war as exceedingly remote and were quite unimpressed by any need for air raid precautions. Anti-gas precautions they considered entirely unnecessary. However, after the crisis of 1938 the medical profession as a whole took a very real interest in medical air raid precautions. There were still individual members, who, on principle, refused to attend instruction. There was still the considerable percentage who ridiculed the need for anti-gas precautions. There was also that other percentage who,
strongly pacifist in their views, regarded the official co-operation of the British Medical Association, in what they called "this war propaganda", as a grave reflection. A meeting of a considerable body of them to protest against the British Medical Association's participation in the Medical Anti-Gas Training Scheme was actually held at the Scottish British Medical Association House in Edinburgh.

Of greater consequence than the above was the influence on anti-gas precautions of several leading medical and other authorities throughout the country. The writer, when visiting a certain Local Authority, one very remiss in the anti-gas precautions of its area, had his argument regarding the necessity for such precautions countered by the words "Breathe Freely". "Breathe Freely" or "The Truth about Gas" by Prof. James Kendall, has had a far-reaching influence throughout the East of Scotland. Professor Kendall writes: "The German High Command must recognise, in spite of all the encouragement of our panic-mongers, that German Air-Raid on Great Britain really constitute, in the present condition of Europe, nothing but an empty threat. It is a threat, of course, against which we must still take active precautions, but it is exceedingly unlikely that any concatenation of circumstances will ever arise that will, in Earl
Baldwin's words, make the game, for Germany, worth the candle."

The book finishes thus:

"Don't panic, you always have two chances.

"There may be another Great War, or there may not. If there is not, there is no need to panic. If there is, don't panic, you still have two chances.

"We may be drawn into this next war, or we may not. If we are not, there is no need to panic. If we are, don't panic, you still have two chances.

"Air-raids on civilians may be renewed, or they may not. If they are not, there is no need to panic. If they are, don't panic, you still have two chances.

"There may be a raid on the city in which you live, or there may not. If there is not, there is no need to panic. If there is, don't panic, you still have two chances.

"Bombs may drop near your house, or they may not. If they do not, there is no need to panic. If they do, don't panic, you now have not two, but three, chances.

"The bombs may be poison gas, incendiary, or high-explosive. If they are poison gas, there is no need to panic; a reasonably gas-proof room and a civilian respirator provide you with double protection. If they are incendiary, there is no need to panic even if one falls right through your roof; you can dispose of it calmly with your little shovel and bucket. If they are high-explosive and fall near enough, you will have no further opportunity for panic. But this third chance, coming after all the preceding ones on the list, is so remote that you may console yourself with the assurance that it is much more likely that a fourth chance will safeguard you against it in advance, namely, a hit from that other type of bomb, the motor-car.

"Unless, therefore, you want to panic about road accidents, there is no need to panic at all."
The book is written throughout with a mixture of seriousness and playfulness, perhaps with more wit than wisdom. "It is exceedingly improbable that any inhabitant of Great Britain will actually undergo a gas attack, except after a heavy meal". .... "There is just as much likelihood of a blanket of mustard vapour reaching the ground as there is of the whiskey, in your glass of whiskey and soda, separating out as a layer of pure whiskey at the surface before you drink it". .... "It is unlikely that there will be another war with Germany in this generation". In 1938, the year in which this book was published, officials of Local Authorities and others, whether accepting the arguments or not, fell under its psychological influence with results to air raid precautions in Eastern Scotland as described above.

The writer remembers, just after having delivered an anti-gas lecture to a class of final-year medical students, standing on the steps of a Scottish University discussing the subject with one of the professors. In this conversation, typical of many held with leading medical men at that time, it was only with great moral courage that the writer persisted in defending the argument for adequate A.R.P. throughout the country. The professor was insistent that there was no danger of gas; with Kendall he held that
common-sense indicated the need for an understanding between Great Britain and Germany; that it was criminal to entertain the idea of a Hitler bent on the destruction of Britain and, to emphasise his dislike of the writer's argument and opinions, he declared: "I do not believe in white or black. I believe in grey." By this of course, he was pinning his faith to the then universally applauded policy of appeasement. With the changed circumstances of war and aerial attack, he has changed his views and is now an ardent supporter of the position he once so strongly denounced. Many others have wisely changed their opinions, but not all. There is still in the country, in the medical world, a decided bias against, not air raid precautions, now that the high explosive and the incendiary bomb have proved their efficiency, but against anti-gas precautions. Too many of our leading medical teachers and other intellectual optimists still argue that for various reasons - our climate with its strong winds and heavy rains, the limited usefulness of gas against a civilian population, the supposed ineffectiveness of gas as compared with the high explosive bomb etc. etc. - gas would be an unlikely weapon, unworthy of our serious consideration.

Not only among the educated public, the medical profession and Local Authority officials has this
attitude been found. In the Department of Health an apparent lack of official zeal and sympathy has been experienced in Anti-Gas Precautions.
CHAPTER VI

SUMMARY AND CONCLUSIONS
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In Scotland, Medical A.R.P. Anti-Gas Precautions are under two Central Authorities, the Ministry of Home Security and the Department of Health. The responsibility of the Ministry ends with the evacuation of the gas casualty from the incident and that of the Department begins when the casualty arrives at First Aid Post or Hospital. While in the ambulance en route from Incident to Post or Hospital, the casualty is in the hands of the Department personnel but Operational Control is still a Ministry matter.

In addition to its medical units, the First Aid Parties, the Ministry has numerous other units which play a part in its medical anti-gas activities, the Gas Identification Service, Rescue Services now interchangeable with the First Aid Parties, Decontamination Parties trained in the detection and decontamination of gas, Wardens trained in gas detection and preventive anti-gas treatment. The Police and Fire Services also have considerable training in the recognition and preventive treatment of war gases.

In Operational Control during action there is
close co-operation between Ministry and Department. In the Medical Training of the A.R.P. Services the Ministry is advised by the Department. But the two units of the Casualty Services under the Department, the First Aid Post and Casualty Clearing Hospital, are completely separate from the Ministry: there is no co-operation and no co-ordination, apart from co-operation in combined training at exercises.

**MINISTRY OF HOME SECURITY: ANTI-GAS PRECAUTIONS.**

It is intended in this Chapter to review the Anti-Gas Precautions in Scotland first of the Ministry and then of the Department, and finally the Anti-Gas Training of the Services and the Public.

The task confronting the Air Raid Precautions Department in the beginnings of passive defence organisation was two-fold, involving precautions against non-gas attack and precautions against gas attack. The foundations of the present Civil Defence structure were laid before there had been any experience of the effects of modern air bombardment by the long-range heavy bomber. Now that this structure has been tried out under blitz conditions by high-explosive and incendiary bomb, how has it stood up to the test? Can we find any relation between the answer to this question and to that of the gas attack? What are the
precautions already made in anticipation of this latter situation? Briefly it can be replied that experience has proved that the A.R.P. pioneers planned well against high-explosive and incendiary bomb attack and that their anti-gas plans were no less carefully prepared and developed.

Before discussing the anti-gas plans in some detail it may be helpful to look at the performance of the Civil Defence organisation in action IN NON-GAS ATTACK. Its Operational Control and individual Services have been subjected to the most severe tests. Raiding in many places has been on a scale corresponding to the maximum offensive capacity of the enemy.

In Civil Defence the essential A.R.P. Services are established on a basis of mutual assistance through Reinforcements, the non-raided Local Authorities coming to the aid of those raided. It has never been the policy to provide each Local Authority with all the personnel and equipment necessary for single-handed, independent defence of its locality but to provide a full establishment over a wider area which could in co-operation meet the full needs of a raided portion of it. Reinforcements have taken a vital part in the heroic work of the Civil Defence Services during 1939-42.
During the blitz period of the raid local A.R.P. units go into action. Raiding has been mostly at night and this has meant, in the average raid, employment during the hours of darkness of the full strength of the local defensive Services. By morning these are exhausted. The raid is over but the work of restoring normal conditions has just begun. Fires started during the raid will still be out of control, trapped injured and uninjured are to be rescued, injured to be treated, dead to be collected and identified, the water, lighting and sewage services to be restored and in addition preparations made to meet a possible second raid at nightfall. It is in this early post-blitz period that the need for adequate reinforcing of the stricken area is most urgent. This in its turn requires a sound system of Operational Control. In all this the Civil Defence Organisation has been found sound and sufficient. No major alteration has been necessary. The post-blitz problem had not been fully visualised but the rapid extension of facilities for the care of the homeless and the restoration of essential public services followed naturally out of the existing machinery.

A feature of raiding has been the large number of casualties. In consequence there has been heavy employment of First Aid Services under the most difficult
conditions anticipated. The equipment of the Parties has proved very good and their numbers greater than requirements, this latter because many casualties trapped in the ruins of buildings have been rescued only after much preliminary demolition and clearance. The rate of rescue has been about one every half hour from badly damaged buildings. The Ministry instruction that casualties should be separated by First Aid Parties into hospital and non-hospital cases, and the serious ones evacuated direct to Hospital without delay, has been wise. This distinction has been obvious even to the inexperienced.

To sum up, the Civil Defence Services have been able to meet all the demands of enemy attack on our cities. Operational Control, Reinforcements and individual Services have benefited from their exacting trials and reach a high level of efficiency in high-explosive and incendiary bomb raiding.

The preparations of Ministry experts in organising FOR GAS ATTACK have been characterised by energy and thoroughness equal to the non-gas activities. Remarkable foresight was revealed by the production of the respirator policy as a psychological and practical defence against gas and in the conception of the Anti-Gas School for the provision by reliable instruction of
a solid base for future developments. Yet the dangers inherent in gas attack are so complex, and defence measures rendered in consequence so exceedingly difficult, that some constructive criticism may be allowed by those who have had long and close experience of the problem, and it is in this spirit that the writer makes the following observations.

DECONTAMINATION OF GAS INCIDENT.

The existing Operational Control of the Ministry can be expected to prove suitable in the event of gas attack as in the non-gas blitz. In respect of the A.R.P. Services themselves, however, there are certain points to be considered. The Decontamination Service is neither organised nor trained for night operations nor the Medical Services to cope with mass gassing of populations in heavily-raided areas.

Using the methods at present employed and with the present organisation, Decontamination Parties could not deal with heavy contamination at night. Decontamination would, therefore, have to wait till morning. We have seen that the A.R.P. Services are directed to incidents through their corresponding Report Centres and co-operate there under the Incident Officer. In the event of gas the efficiency of the Services will depend on freedom from contamination,
but if decontamination of the incident cannot be done
till morning they will be in danger of early and heavy
contamination, resulting possibly in the wholesale
depletion of First Aid and other personnel. This is
what the writer would anticipate, under existing
conditions. There are two contrasting necessities:
avoidance of delay in essential Services such as First
Aid Parties getting to work, and protection of these
valuable units against contamination at the incident.
Some simple and rapid method of decontamination at the
incident applicable in darkness is essential. The
writer believes that bleach powder either dry or,
preferably, in a watery paste should be carried by
First Aid units going into contaminated areas. This
would be used by them to decontaminate the immediate
area surrounding the casualty, their gloves as
contamination of these recurred, stretchers and other
equipment. Parties would be guarded as against
surprise concentrations of gas from other areas up
wind, fresh bombs and so on, by the posting of scouts
upwind and the use of a code of signals, lights or
whistles.

These precautions, while adding greatly to the
safety of personnel working in lightly contaminated
areas, would not meet the case in areas of extensive
contamination. What is required for this, and could be
provided, is a highly mobile Decontamination Service capable of the decontamination of an area in a matter of minutes, thus removing the danger of contamination to the Civil Defence Services and permitting their speedy entry to the incident. By this means contamination could be kept in check during the raid and the work of other Services facilitated while the danger to the civilian population would also be greatly lessened.

Since commencing this thesis the writer has learned that the Ministry intend adopting in their decontamination procedure the substitution of dry bleach powder for application to streets, and water for contaminated debris. A demonstration for Senior Officials is being arranged to take place in the West of Scotland during March. This reveals an official appreciation of the inadequacy of previous arrangements for dealing with contamination, but it is not sufficient. The present Decontamination Service requires to be reorganised on the basis of speedy concentration for rapid decontamination, that the gas incident be made safe for the Services. A similar reorganisation has recently been effected in the Auxiliary Fire Service. To protect the individual unit from surprise danger and to permit it to deal with local contamination which may interfere with its activities, individual units should have their own supply of bleach powder and paste.
(The Regional Training Bulletin of the Ministry in Scotland for March states that its experience of air raids has made it evident that it would be impracticable for the work of decontamination to be started during the night. But this is unlikely to represent the true position. While it will be the intention of the authorities to leave as much decontamination as possible till morning, it will not be their intention that the Services turn out into heavily contaminated areas without every effort being made to deal with the danger from liquid gas present.)

MASS GASSING OF CIVILIANS.

While the establishment of First Aid Parties has been found to be in excess of requirements up to the present, this position is likely to be reversed in the case of gas attack. Through the broken doors and windows gas will reach those in damaged houses who otherwise would not need first aid attention. The interchangeability between First Aid Parties and Rescue Parties may not help to strengthen the numbers available for first aid, as rescue work will make its own heavy demands on the Services. The problem of the uninjured gas casualty is an important one. Three factors influence it: the type of gas used, the number of persons affected and the severity of symptoms. The gases which produce immediate symptoms have a
definite panic danger, smaller numbers of casualties will be more easily handled than larger, and victims seriously affected will make heavier demands on time and treatment, and present a more difficult problem in evacuation from the incidents.

In using gas against a civilian population, it will be to the advantage of the enemy to employ a mixture of gases. Therefore, unless liquid vesicants are eliminated, the immediate treatment and initial disposal of the uninjured gas casualty become complicated. Who would send liquid contaminated victims to a Rest Centre, yet how can they be separated, or must all go through the cleansing process at some Post or Centre? It is to be remembered that the First Aid Parties will have this position to handle, under present arrangements. The question arises, Could First Aid Parties deal with large numbers of casualties of this type? The answer must be, No. There is indeed no present organisation in the Civil Defence Service to tackle such a situation.

In one minor raid in the writer's experience, three small bombs fell in a street of high tenements. All the windows and many of the doors in that street, and most windows in neighbouring streets, were shattered. There were fully two thousand people in
the houses involved at the time. All of these would have been exposed to gas in the event of a gas bomb falling in the vicinity; rattles could hardly have been sounded in time to give warning. In any case they would have had to be evacuated to a safe place. In the event of their having been affected by the gas, or even a proportion of them, what steps would the authorities have taken to meet the position? The damaged houses offering no protection against the gas, the victims would have gone out into the darkness not knowing which way to turn to escape contamination. If, in addition, they had discovered that the A.R.P. Services were unable to help them, a situation might have developed which could very soon have got out of hand.

If the enemy were to limit his gases to the more insidious type like mustard gas and phosgene, the problem envisaged above would be much less urgent. It is necessary, however, to assume that gases such as the nasal irritants will also be employed and that the methods of dispersal employed by the enemy will be efficient. In the example given above it would have been well within the effective range of nasal irritant gas to have produced five hundred up to two thousand casualties within a few minutes. The physical agony and mental distress of nasal irritant victims has to
be seen to be fully appreciated. It is physically impossible to retain the respirator in position. Thus the problem of the uninjured gas casualty may prove a major problem of gas attack, and of great significance in the event of attempted invasion.

It is the writer's experience that the potential danger of nasal irritant gas attack on our cities has not been adequately anticipated in our Civil Defence Services. Nor is the problem of the uninjured gas casualty appreciated. This is obviously not a responsibility that should fall on the First Aid Party alone. It calls for speedy action with, as its main objectives, the countering of panic by firm handling and adequate provision for victims, the prevention of greater injury from exposure to more dangerous gases, and the distinguishing of the really serious cases from the others. This would involve disciplinary control, with the aid of police, wardens, and military if necessary, who would shepherd them to suitable centres e.g. First Aid Posts or Rest Centres, for medical inspection and treatment.

TREATMENT OF THE GAS CONTAMINATED CASUALTY.

The problem of the uninjured gas victim leads on to a consideration of the treatment of contaminated casualties, wounded and unwounded, and whether or not
gassed by some other gas. Our washing procedure is complicated and difficult. Three demands are made on the victim, and on the medical personnel, first, attendance at a Cleansing Centre; second, the complete removal of clothing and third, the washing of the whole body with soap and water. Are the advantages of this treatment such as justify all it involves? Clearly they would have to be real and lasting. Actually they are very limited and unlikely to be of value to any but a fortunate minority.

Washing treatment in the case of liquid mustard gas contamination must be applied in five minutes to be effective, and, in the case of lewisite, in less than five minutes. Anti-gas ointment is more effective treatment than the cleansing process in liquid contamination. For vapour cases washing treatment is of little value after ten minutes, none after half an hour and even if carried out successfully it might only lessen the resulting burn; it could not prevent it. In cases already showing erythema of the skin, washing is contra-indicated. To the small number of cases who might succeed in reaching a Cleansing Centre and being washed within fifteen minutes of contamination the washing process might have limited, beneficial results. To all others it offers nothing beyond removal of contaminated garments. In
the case of the contaminated injured casualty the washing process would be actually harmful because of the exposure and handling caused, with almost certain increase in shock. No. 2 Ointment is easily and quickly applied, and effective against both liquid and vapour.

In addition to the washing facilities in First Aid Posts, there are the Cleansing Centres and Mobile Cleansing Units already mentioned. This must represent, in Scotland, a provision running into tens of thousands of showers, and an expenditure proportionately great. This is of psychological value in the event of heavy gas attack on cities, but it fails as an adequate measure in preventive treatment for contaminated gas casualties.

Ministry officials cannot be in ignorance of this fact, and may now have ceased to rely on the First Aid Post and Cleansing Centre for preventive treatment. The recent Ministry plan for the extension of washing facilities by the GOOD NEIGHBOURS' PLAN can be interpreted as evidence of its concern, and an attempt to meet the urgent need. This Good Neighbours' Plan, therefore, will be examined as to the advantages, if any, it may have over the Post and Cleansing Centre.
According to this plan, contaminated persons are to find washing facilities in the houses of private individuals who are willing to co-operate as Good Neighbours, providing hot water and soap, assisting in the washing of the victim, lending personal clothing, and supplying the necessary pails, stirrup-pump, towels and dustbin. The victim returns the loaned clothing at the first opportunity. To the casualty finding such assistance in the vicinity of the raid, the plan does offer a better chance of timely application of the washing process than the more distant Post. Difficulties, however, operating against any such good fortune, are obvious - proximity to the raid incident, darkness, and the danger of exposure to the Good Neighbours of gas contamination by opening doors. The successful performance of the official suggestion of stripping the victim and washing the skin by means of a bucket of water and stirrup-pump in the back garden or yard of the house, assumes a degree of expertness on the part of the Good Neighbour and full co-operation on the part of the victim. But, in the darkness, how is the victim to be guided to the Good Neighbour's house, and will the good neighbour's assistance be of value at all in a case complicated by injury and/or other gases?

Let it be assumed that the above difficulties
have been overcome, the victim has reached a Good Neighbour and been treated effectively within fifteen minutes of contamination. Will the washing process obtained with difficulty and by extraordinary good fortune, benefit him or her more than treatment by Protective Ointment No. 2 self applied? We have already seen that the ointment is effective against vapour, and much more so against liquid, mustard gas. The casualty has benefited by removal of clothing and treatment of vapour contamination of the skin, but has not been effectively treated for liquid contamination of the skin. If there has been delay in obtaining washing, then the benefits are nil as preventive treatment.

It is difficult to imagine how the Good Neighbours' Plan could be operable sufficiently near the gas incident to be within timely access, or how the gas victims could locate the Good Neighbours in darkness. People in the vicinity of a gas incident should keep under cover, sealing their doors and windows against gas as far as possible. The Good Neighbours' Plan has, in the writer's view, no advantages over the Post or Cleansing Centre, and has additional disadvantages. Yet the Ministry is urging this new policy, and also increasing the provision of the impracticable Cleansing Centre.
We have seen that there are three outstanding problems of the large-scale gas attack awaiting solution: first, speedy decontamination of the incident for the protection of essential personnel; second, machinery to cope during raids with large numbers of gas casualties suffering from toxic smokes, to prevent panic among them and to remove them from the danger area; and, third, the cleansing of the contaminated victim.

The first of these should not remain a problem, for its solution is a matter of organising; if not adjusted prior to gas raiding, it would quickly solve itself under stress of necessity, though it is to be hoped that preparations will have been made in time. Dangers of contamination have been exaggerated in the past, but they are not less than they have always been, and risk lies not in over-preparation but in under-preparation. The second and third problems will at once be minimised by the solution of the first. When contamination has been speedily eliminated from the gas incident rescue and first aid work will be able to proceed normally, civilian casualties will be reduced, and movement in and through the area will allow the evacuation of civilians.

A vital factor in meeting the whole problem of
the gas attack is the gas discipline of the public. THE ANTI-GAS TRAINING AND GAS DISCIPLINE OF CIVILIANS will determine the success or failure of the gas blitz. The respirator gives full protection to eyes and lungs against all war gases. Protective Ointment No. 2 if applied at once will prevent mustard gas poisoning of the skin, and water will do as much in lewisite poisoning. The removal of the outer garments within twenty minutes will prevent serious damage to the skin except in heavy contamination. The nasal irritants are without danger to life. It is, therefore, in the hands of the individual to ensure personal safety against gas, provided there is no physical injury. This at once brings the gas danger within the limits of the recognised high-explosive and incendiary bomb danger, only the serious and injured gas casualty requiring the services of the First Aid Party. It is something that can be visualised, and against which there is reasonable protection. The great majority of gas cases in mass gassing of the population will be uninjured and only slightly injured, and able to apply their own treatment.

The state of gas discipline in Scotland, judged from the number of persons carrying respirators, is unsatisfactory. Considering also those whose respirators are not in good repair nor of the right size, and those who have little or no knowledge of adjusting them
and experience in wearing them - of vital importance - the position is seen to be alarming. - Recently an official in receipt of a large salary and occupying a responsible position in the training of A.R.P. Services asked the lecturer to explain the meaning of the letters "C.A.P."

Officials of the Central Department responsible for Medical Anti-Gas policy in Scotland do not know simple facts of preventive or first aid anti-gas treatment and could not look after themselves in an emergency. At the start of the war medical and nursing staffs of hospitals ceased to receive training in the treatment of the gas casualty. The respirators of the nursing staff of a large hospital were found to be mainly defective. Teachers in our schools have no training in preventive and first aid treatment for gas. If the state of gas knowledge and training among these responsible sections of the community is such, what must be the standard of gas discipline throughout the population generally?

Estimated from the numbers of those who have had training in the simple rudiments of personal protection and preventive treatment, it is practically non-existent.

All the excellent, but limited, publicity which the government has carried out by leaflets, pamphlet and advertisement, cannot take the place of the
systematic instruction of the public, by lecture, demonstration and practical test. This has been neglected. We cannot as a nation afford, in the face of a mighty and unscrupulous enemy, to permit the continuance of the weaknesses here described in our medical anti-gas precautions.

DEPARTMENT OF HEALTH: ANTI-GAS PRECAUTIONS.

We are concerned in this thesis with the (casualty) medical aspects of anti-gas precautions. The medical and semi-medical A.R.P. units which will operate at the incident, First Aid Parties, Rescue Parties and Decontamination Service, along with the Gas Identification Officers, are all, and their Operational Control, under the Ministry of Home Security. Operational Control continues to be a Ministry responsibility up to the point of handing over the casualty to First Aid Post or Casualty Clearing Hospital. The Department is responsible for that aspect of initial gas precautions touching the casualty during and after evacuation from the incident, providing for the immediate reception and treatment of large numbers of victims. Casualty Ambulances, First Aid Posts and Casualty Clearing Hospitals, as we know, form the Department's Casualty Services. The Department has not always been responsible for the A.R.P. Casualty Services. Up to the end of 1938 they were under the A.R.P. Department of
the Home Office, and as such had developed during the three preceding years.

When, therefore, the Casualty Services passed to the Department, they passed into the hands of lay-officials who had neither experience nor training in Air Raid Precautions. In the experience of the writer, who has participated in the developments under both Authorities, it would have been better had the Casualty Services remained under those who were already expert in this new defence organisation, who were gas-minded and who would have maintained them along the lines on which the main A.R.P. organisation was already running. It soon became evident that the Department intended to develop the Casualty Services in its own way. It did not consult with the Ministry officials in Scotland nor communicate its decisions to them. Its Instruction regarding the initial disposal of casualties and the gas contaminated cut right across the existing Ministry Instruction, causing confusion that lasted for over two years. On its erroneous dictum regarding the killing properties of mustard gas was based its anti-gas policy.

In the three years after the Department assumed responsibility for the Casualty Services of Scotland, none of its officials, architects or medical officers
engaged on the anti-gas side, received any instruction in either Air Raid Precautions or Anti-Gas Precautions. The Home Office has two first class training establishments, at Falfield and at Easingwold, equipped and run at great expense, staffed by experts of proved ability and giving instruction of a very high standard. The Department could, therefore, have given its officials the necessary training. District Hospital Officers have requested permission to attend the Schools but have been refused. Thus all the Anti-Gas Sections of Posts and Hospitals, their selection and construction, were in the hands of Department officials untrained in Air Raid or Gas Raid Precautions. Not many months ago the writer personally made certain suggestions, to the senior official of the Department responsible for that branch, for the improvement of cleansing facilities at First Aid Posts. He listened in sympathetic attitude but said, "— man, — what do you expect? Posts do not have cleansing arrangements." It took the writer twenty minutes to convince him that Posts not only have such facilities but have had them for over three years. Scheme-making Authorities have availed themselves of the Ministry Schools, and large numbers of their officials are now qualified instructors with experience. Thus, when the Department official visits the local area, he is as an amateur advising and reporting on the expert.
The First Aid Post in Scotland, in almost every instance, is a modification of an existing building. The writer has no knowledge of an ad hoc Post anywhere. Part of the building has been set aside as Surgical Section and part as Cleansing Section. The necessary alterations have resulted in great expense - (on an average, perhaps, £600 per Post, though the writer has no official figures) - planned and carried out by lay-officials, guided mainly by their own personal ideas and interpretation of the A.R.P. Handbooks. The writer would regard as an optimistic estimate that one in ten would function under blitz conditions involving the Cleansing Sections. Criticism of the Cleansing Sections might be directed either to construction or to procedure. With regard to the latter, the personnel have not received an authorised procedure to follow, and every Local Authority is a law unto itself in the way in which it proposes to handle its gas casualties - the procedure chosen invariably breaking down during practice tests in combined exercises. Procedure may change from Post to Post.

There is still no fixed policy of anti-gas cleansing provision for Casualty Clearing (or Reception) Hospitals. The Department has, under pressure, approved the provision of individual cleansing huts. Its officials untrained in Gas have worked on 'common
sense' lines as to what they would allow, apparently resisting local demand as long as possible and then giving as little as possible, with the result that it is questionable if any of the hospital cleansing units provided between 1939-41 would be usable in a gas blitz. The majority are not in any way suited to the purpose for which they have been intended. Having no instruction on procedure from the Department regarding the contaminated stretcher case, each Casualty Clearing Hospital has drawn up its own procedure, influenced in doing so by the Department's attitude towards mustard gas as being lethal. During trial tests in Combined Exercises, the procedures that the writer has seen in action have all fallen into a state of confusion.

Thus, after three years under the Department, the anti-gas branch of the Casualty Services remains below the essential standard of efficiency. It could not be expected of non-trained lay-officials to keep abreast of research work, maintain a critical watch over the evolving organisation and guide its development. And yet the safety of the nation might depend on the efficiency of its anti-gas policy. In the Department the medical officers are technical advisers only. The Chief Medical Officer has no power to direct or alter policy, nor can he authorise the expenditure of one penny. He can only advise and lay-officials may
take his advice or they may not. In practice medical decisions are taken by them. This, naturally, is a source of friction between Chief Medical Officers and the Department. The obvious observation to be made is that the final authority in policy and expenditure in medical matters should be limited to the medically trained officials of the Department.

In pointing out the unsuitability of present medical anti-gas measures in Casualty Posts and Hospital, the writer would make the following three suggestions as a guide to a practical policy - one, that all contaminated, wounded or unwounded casualties be admitted at Post or Hospital, as the case may be, into a well-lit and warm room immediately; two, that no clothing be discarded till the patient is inside the Post or Hospital; three, that for the washing process be substituted the use of bleach paste, solvents or Protective Ointment No. 2, Dettol, H₂O₂ etc. At Hospitals, wounded contaminated casualties would be brought at once into a warm well-lit room and examined, the amount of cleansing treatment in each case depending on the patient's condition. No attempt would be made to wash, but No. 2 Ointment would be used liberally. At Posts, unwounded would on admission be inspected without delay for contamination, given a numbered bag and instructed which articles of clothing required immediate
removal to the bag. Contaminated skin would be treated by No. 2 Ointment. The patient himself would carry out this treatment and pass his discarded clothing through the appropriate trap door to the outside. Wounded cases would require assistance in the removal of clothing and application of ointment. Further treatment, irrigation of eyes, instillation of albucid soluble, hydrogen peroxide soaks etc., would be applied, as required, in the usual way. Drawbacks to this procedure might be contamination of the floor and the presence of vapour from clothing. Bleach on the floor of the dirty side of the entrance room would prevent the first, and, boots having been discarded there, simple methods of ventilation would control the second. It is not suggested that one hundred per cent safety can be obtained. The great majority of contaminated walking cases will have very slight contamination, and many who come for cleansing will not be contaminated with liquid and perhaps not at all. The arrival of a batch of heavily contaminated cases would, of course, be the signal for special care in this simple procedure outlined - thorough ventilation of the room and passage, and the use by the Post personnel of gloves, respirators and an overall of protective material.

In the TRAINING of the A.R.P. Services, the Ministry has done an important work well, aiming at
training being uniform and the standard high. On the non-gas side the success of the Schools has been reflected in the high standard of efficiency in the local A.R.P. Services. But in anti-gas tests Service medical personnel, now very efficient in first aid work, do not come up to standard. This is observed during exercises in all the A.R.P. Services, whether operating at the incident, the Post or the Hospital, and is caused by a deficiency in anti-gas instruction and training. A Medical Training Officer, to cooperate with the corresponding Training Officer of the Ministry, is required. Also influencing medical anti-gas training is the fact that the A.R.P. Handbooks are out of date in their teaching on the medical anti-gas treatment of the important gases. Revision in this section is necessary and the Ministry should take the initiative in this at once. For all A.R.P. personnel of Parties, Posts and Hospitals, up to date gas instruction is urgently essential.

In heavy gas raiding the question of civilian morale is vitally involved. High-explosives and incendiary bombs are more to be feared physically than gas, but the danger of gas is mainly to morale. The gas-education of the population is the answer to this. So far the measure of the success of our methods is the immunity we have enjoyed from attack. In the absence
of a lead from the Department of Health, it is no matter for surprise that little is being effectively done in Scotland in the organised training of the public. In the instruction of the public in anti-gas subjects with, as its main objective, the training and practice of the individual in personal protection, there is no unsurmountable difficulty, but it will take time. It is a measure which will repay steady, determined effort. It should be undertaken before it is too late: the machinery for it already exists in the local A.R.P. organisation. A prepared and confident population will be the masters, not the victims, of gas attack.
APPENDIX I. SYLLABUS OF HOME OFFICE MEDICAL ANTI-GAS COURSE OF INSTRUCTION (1936-1939) — Thesis p. 7

APPENDIX II. SUGGESTIONS FOR P.M.'s MATERIAL BY PROFESSOR CAMERON, PORTON — Thesis p. 69

Seven weekly meetings of two hours' duration consisting of theoretical and practical instruction.

The place of the doctor in Air Raid Precautions.
Individual Protection.
Methods of Gas Attack.
Outline of the War Gases.
The Eye and Nose Irritants: chemical and physical properties, symptoms and treatment.
Questions and discussion.

LECTURE 2. The Respirator - mechanical and chemical detail.
The fitting, wearing, care, cleansing, disinfection and repair of the respirators.
Different types of respirators.
Respirator drill.
Questions and discussion.
LECTURE 3. The Medical Classification of Gases.
The lethal gases - chemical and physical properties, symptoms, first aid and medical treatment.
Respirator drill with Service, Civilian Duty and Civilian respirators.
Questions and discussion.

LECTURE 4. The Blister Gases - chemical and physical properties, symptoms, preventive first aid and medical treatment.
Protective clothing.
Demonstration of cleansing of A.R.P. personnel in cleansing depot.
Questions and discussion.

LECTURE 5. The Blister gases continued.
Demonstrations - the cleansing of contaminated wounded and unwounded casualties by First Aid Parties, First Aid Posts and Casualty Clearing Hospitals.
Questions and discussion.

LECTURE 6. Collective protection - the gas proof room.
Demonstration - Air locks methods of gas proofing doors, windows, floors, fireplaces etc.
Questions and discussion.
LECTURE 7. Decontamination of foodstuffs, clothing and materials.
Questions and discussion.
The testing of respirators in tear gas chamber.

Attendance at six out of seven meetings qualifies for a Home Office Certificate of Medical Anti-Gas Training in Air Raid Precautions.
Appendix II.

SUGGESTIONS FOR P.M.'s MATERIAL BY
PROFESSOR CAMERON, PORTON.

Collection of pathological material.

1. Material should be sent as soon as possible to:

2. Pieces of tissue should be about 2 x 1 x 0.5 cm, and preferably fixed in 10% formol saline in at least 20 times the volume of tissue. When possible, skin should be fixed in Susa, otherwise in 10% formol saline.

3. The following tissue should be collected:
   i. Skin burns, the tissue to include the margin with a piece of normal skin.
   ii. In cases with pulmonary features, trachea, main bronchi, lung near hilum and at site of lesions. Both lungs should be sectioned, the pieces indicated by a tag attached.
   iii. Liver, including gall bladder and terminal inch of common bile duct.
   iv. Any gastric or intestinal lesions, with a mediastinal lymph gland.
   v. In all cases pieces of heart muscle (left ventricle), kidney, spleen, adrenal

4. With severe lesions in trachea, lungs, liver, kidneys or brain, it would be an advantage to send as much of the affected organ as possible. This should be wrapped in 10% formol saline saturated gauze.

5. A short summary of clinical notes and a copy of the post-mortem report must be included.

6. Material should be sent in one or two six ounce, wide-mouthed, glass bottles containing 150 c.c. 10% formol saline. The stopper should be sealed off with paraffin.
# Appendix III

## Time Table

**(Instructors' Course - Medical Anti-Gas Measures)**

*(2nd to 6th June 1941)*

<table>
<thead>
<tr>
<th>Time</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Forenoon.</strong></td>
<td><strong>10 - 11.15 a.m.</strong></td>
</tr>
</tbody>
</table>
| MONDAY        | Lecture  
              | Physical & Chemical Properties of War Gases  
              | Prof. W.M. Cumming  |
| TUESDAY       | Lecture  
              | Gas Identification  
              | Prof. W.M. Cumming  |
| WEDNESDAY     | Lecture  
              | Contamination and Decontamination  
              | Dr. Hay.  |
| THURSDAY      | Lecture  
              | Eyes  
              | Major Scott, R.A.M.C.  |
| **11.30 - 1 p.m.** | Lecture Demonstration  
                     | Outline of E.M.S. and Casualty Services.  
                     | Operational Control etc.  
                     | Dr. Hay.  |
|               | Demonstration  
              | Cleansing of stretcher wounded at Cleansing Section of Reception Hospital  
              | Dr. Hay.  |
|               | Demonstration  
              | The removal and handling of casualties during a gas incident  
              | Dr. Ford Robertson.  |
|               | Lecture  
              | Skin and Mucous Membrane  
              | Prof. J.M. Macintosh.  |
| FRIDAY        | Doctors: -  
              | Nurses: -  
              | Written Paper  
              | Orals and Practical.  |
### Afternoon.

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 - 3.15 p.m.</td>
<td><strong>Lecture</strong>&lt;br&gt;General introduction to War Gases - early effects.&lt;br&gt;Eye and Nose Irritants. Symptoms and Treatment. Dr. Hay.</td>
</tr>
<tr>
<td>3.30 - 5 p.m.</td>
<td><strong>Demonstration</strong>&lt;br&gt;Cleansing of contaminated persons at First Aid Posts and Cleansing Centres. Dr. Hay.</td>
</tr>
</tbody>
</table>

**Monday**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lecture</strong></td>
<td>Individual Protection. Respirator. Protective Clothing etc. Dr. Hay.</td>
</tr>
<tr>
<td>INTERVAL - 15 MINUTES</td>
<td></td>
</tr>
<tr>
<td><strong>Demonstration</strong></td>
<td>Decontamination of (a) Clothing (b) Materials. Dr. Hay.</td>
</tr>
</tbody>
</table>

**Tuesday**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lecture</strong></td>
<td>Pharmacology and Systemic effects of War Gases. Prof. A.J. Clark.</td>
</tr>
<tr>
<td>INTERVAL - 15 MINUTES</td>
<td></td>
</tr>
<tr>
<td><strong>Demonstration</strong></td>
<td>Fitting, wear, decontamination of respirators protective clothing etc. Dr. Hay.</td>
</tr>
</tbody>
</table>

**Wednesday**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Lecture</strong></td>
<td>The Lungs Prof. Noah Morris.</td>
</tr>
<tr>
<td><strong>Practical</strong></td>
<td>Gas Chamber Test. Dr. Hay.</td>
</tr>
</tbody>
</table>

**Thursday**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exam</strong></td>
<td>Doctors: - Orals and Practical&lt;br&gt;Nurses: - Written Paper</td>
</tr>
</tbody>
</table>
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THE MEDICAL ASPECTS OF CHEMICAL WARFARE - (VEDDER).

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AIR RAID (JOHN LANGDON DAVIES).

MEDICAL ORGANISATION AND SURGICAL PRACTICE IN AIR RAIDS (MITCHINER AND COWELL).

BREATHE FREELY! THE TRUTH ABOUT POISON GAS (JAMES KENDALL).

DIAGNOSIS AND TREATMENT OF GAS CASUALTIES (B.M.J., 10TH MAY 1941).

MEDICAL MANUAL OF CHEMICAL WARFARE, 1940 REPRINTED WITH AMENDMENT NO. 1, 1941. (WAR OFFICE).

AIR RAID PRECAUTIONS HANDBOOKS:

No. 1. Personal Protection Against Gas.

No. 2. First Aid And Nursing For Gas Casualties.

No. 3. Medical Treatment Of Gas Casualties.

No. 4. Decontamination Of Materials.

No. 4A. Decontamination Of Clothing.

No. 8. The Duties Of Air Raid Wardens.

No. 10. Training and Work Of First Aid Parties.
AIR RAID PRECAUTIONS MEMORANDA:

No. 2. Rescue Parties and Clearance of Debris.
No. 3. Organisation of Decontamination Services.
No. 4. Organisation of the Air Raid Wardens' Service.
No. 5. Anti-Gas Training.
No. 6. Local Communications and Reporting of Air Raid Damage.
No. 9. Notes on Training and Exercises.
No. 11. Gas Detection and Identification Service.
No. 15. Care and Custody of Equipment.

AIR RAID PRECAUTIONS PAMPHLETS:

Protection of Foodstuffs against Poison Gas.
What you must Know - What you must Do.
Your Home as an Air Raid Shelter.

CIVIL DEFENCE Publicity Information Leaflets Nos. 1 & 2.

MINISTRY OF HOME SECURITY (A.R.P. DEPARTMENT):

The Detection and Identification of War Gases.
A Guide to Combined Exercises with Examples 1 to 5.

A.R.P. TRAINING MANUALS:

No. 1. Basic Training in Air Raid Precautions.

A.R.P. TRAINING BULLETINS 1-4.