CHAPTER 11

MEDICAL SUPPORT IN CHEMICAL OPERATIONS

SECTION I - INTRODUCTION

1101. General.

a. Medical operations in a chemical warfare environment will be complex. In addition to providing care in protected environments or while dressed in protective clothing, medical personnel will have to treat chemically injured and contaminated casualties, sometimes in large numbers.

b. A mass casualty situation occurs whenever the numbers or type of casualty exceeds the capabilities of the unit to treat and manage them in a normal fashion. An erroneous reaction to such a possibility is to assume that the problem is too great to cope with and preparations would be futile. Rather, the success of the medical department to function effectively in a chemical war and to treat, successfully, the maximum number of casualties will directly relate to the efforts made in advance to prepare for the possibility.

c. The doctrine, organisation and equipment available to handle chemical casualties will vary between countries and most particularly between Services, because of differences in military operational requirements. However, whatever the system there will be a common set of problems that must be addressed in the management of chemical casualties because the clinical condition of the casualty will be the same or similar regardless of which Service he or she is a member, and because of similarities in the environment in which the casualty must be treated.

1102. Objectives of Medical Support in Chemical Operations.

The objectives are:

a. To conserve the fighting strength.

b. To continue to provide medical services and support to the maximum extent possible.

c. To protect medical personnel from chemical injuries while handling contaminated casualties, or while working in contaminated areas.

d. To minimise morbidity and mortality from conventional and chemical injuries.

e. To avoid the spread of contamination into medical vehicles and facilities.

1103. Characteristics of Chemical Agents.

a. The physical characteristics of chemical agents have been described in the individual chapters for each class of chemical agent. These characteristics, the method of employment, and the meteorological environment in which they are used will have a major impact on the type and number of casualties produced.

b. Some agents, such as nerve agents, cyanide, and phosgene are highly lethal, and a

large proportion of casualties may die unless care is given immediately after an attack. Other agents, such as mustard and Lewisite may be more incapacitating than lethal. The onset of symptoms will differ by type of agent and by route of exposure. Nerve agents and cyanide, especially by the inhalation route of exposure, are characteristically very rapid in onset of effects, whereas mustard and phosgene may have a latent period of several hours between exposure and onset of symptoms. During the latent phase the prognosis and future clinical course will not be apparent and the decision on whether to treat or evacuate will be difficult.

1104. Contamination Control.

a. One of the most difficult aspects of chemical warfare is that the chemical agents may persist in the environment for extended periods of time. This is especially true of agents such as VX, the mustards, thickened GB, or GD, which may remain as contact hazards for hours or days.

b. On the chemical battlefield, three types of environments may exist:
   (1) An uncontaminated area where there are no chemical agents present.
   (2) A contaminated area where chemical agents are present in a liquid state (and probably in a vapour state as well) presenting a surface contact hazard.
   (3) A vapour-only environment, for example, in a downwind hazard area.

c. Complete decontamination of a contaminated environment may be difficult or impossible. However it may be possible to achieve sufficient decontamination, particularly in small areas, to create a vapour only hazard area. Thus it may be possible to decontaminate equipment so that no further surface contact hazard exists, even though chemical agent vapours may continue to be off-gassed from agent adsorbed onto or absorbed into the surface. In such environments, it may be possible to work without the full protective clothing ensemble, although respiratory and eye protection would still be required. This is because most agents in a vapour state penetrate through the skin very slowly. However, mustard at high vapour concentrations may still cause skin injury, particularly if the skin surface is wet or moist as may be the case in a warm environment.

d. Where a liquid hazard exists, decontamination of skin and eyes must be accomplished quickly if it is to be effective. Chemical agents may penetrate or react with the skin and eyes within minutes, so successful decontamination must be carried out immediately after exposure. Once agent is decontaminated, or has been absorbed, no further risk of contamination exists. The casualty's body fluids, urine, or faeces do not constitute a CW hazard.

e. Individual and collective protection are the first line of defence against chemical agent contamination. Individual protection comprises the respirator and protective clothing including gloves and boots. Full protective clothing is particularly important for persistent agents and agents that pose significant skin injury or skin penetration effects. For agents posing a respiratory or eye injury threat exclusively, the respirator would suffice. Individual protection imposes physiological and psychological stress on the individual, impairs communication, and reduces performance to a certain degree, depending on the individual's job performance requirements.

f. Collective protection is desirable, particularly for medical care. Adequate collective protection may not be possible, or may be difficult to achieve and will require personnel and equipment resources. In some instances, it may be feasible to establish a vapour only hazard area, and work within that area at less than full individual protection, such as using respiratory and eye protection. Limited medical care can be achieved in this manner, but full examination and definitive surgical treatment is impossible without full collective protection.

g. Collective protection provides the capability to medically manage severely toxic or injured decontaminated casualties in an environment where medical personnel are unencumbered by wearing individual protective equipment. Likewise, the casualties benefit from the capability of the medical unit to make full use of available medical equipment and procedures. A significant percentage of casualties (15-30%) can not be adequately treated in a contaminated environment without collective protection as their treatment requires the removal of their respirator.

h. In the presence of a CW threat, equipment and supplies should be kept in unopened, sealed or covered containers until required for use. The use of chemical agent resistant material (CARM) will provide good protection against liquid contamination, but even the use of conventional tentage will significantly reduce contamination by a liquid agent for a limited period.

1105. Mass Casualties.

a. Chemical weapons may cause large numbers of casualties in poorly protected or untrained personnel. World War I experience showed that large numbers of casualties most frequently occurred with units that were surprised or inexperienced in chemical warfare. Such casualty surges will require careful preplanning and training for medical units if they are to continue to operate efficiently.

b. All medical units must be prepared to receive mass casualties caused by or contaminated with chemical agents. Mass casualties are considered to be those who are produced within a relatively short period of time and who because of their number and type exceed the medical support capabilities for their care.

c. Casualty sorting must take into account the possibility that some casualties may be contaminated. Some provision for emergency treatment of contaminated casualties needs to be made, since some critical care may be required before decontamination can be accomplished. Proper triage procedures are an essential element in handling large surges of casualties. (See Paragraph 1107.) With adequate advance planning and training, mass casualty situations can be managed and excessive morbidity and mortality reduced. Lack of such preparation, or a mistaken belief that such preparations are futile, are sure ingredients for disaster.

1106. Medical Decision Making.

a. Differential diagnosis is one of the first and most difficult aspects of managing chemical casualties. Unless it is known to which agent the casualty was exposed, it may be difficult to establish a diagnosis with certainty. Further, the casualty may

still be partially or fully encapsulated in a protective ensemble, precluding elucidation of any but the most simple signs and symptoms. Knowledge of the principal signs and symptoms is necessary to determine the clinical diagnosis. The rapidity of the onset of symptoms may be an important clue, for example in nerve agent poisoning or cyanide poisoning. In some instances, it is better to act rather than try to obtain a certain diagnosis, particularly if the condition of the casualty is serious and rapidly deteriorating. In forward treatment areas, the diagnosis should be kept as simple as possible, and be keyed to making decisions that will lead to some specific action or actions.

b. When chemical casualties are received at a medical unit, they may also have traumatic wounds or illnesses due to other causes. These patients must be managed so as to minimise the injuries resulting from chemical exposure without aggravating their traumatic wounds or illnesses.

1107. Triage.

a. Triage is one of the most important tools for handling combat casualties, particularly in mass casualty situations. Basically, it is a medical decision process used to arrange casualties in priority order to ensure the most effective use of limited medical resources and minimise morbidity and mortality. Triage is a continuous, ongoing process through the casualty care chain and should be utilised whenever casualties must be assigned priority for treatment, evacuation or decontamination. Triage decisions should be made by highly experienced personnel familiar with chemical and conventional injuries. Triage criteria should be determined in advance and practised. They must be relevant to the medical capabilities of the medical unit. The four standard NATO mass casualty triage categories, adapted for chemical casualties, are as follows:

(1) *Immediate treatment (TI).*This includes those requiring emergency life saving treatment. Treatment should not be time consuming or require numerous, highly trained personnel, and the casualty should have a high chance of survival with therapy.

(2) *Delayed treatment (T2). The* general condition permits some delay in therapy although some continuing care and relief of pain may be required before definitive care is given.

(3) *Minimal treatment (T3).* This includes those with relatively minor signs and symptoms who can care for themselves or who can be helped by untrained personnel.

(4) *Expectant treatment (T4).* This group is comprised of patients whose treatment would be time consuming, require numerous highly trained people, who have life threatening conditions beyond the treatment capabilities of the medical unit, and would have a low chance of survival. It must be noted that the decision to place a casualty in the expectant category is not necessarily a decision to render no therapy. Rather, the triage categories determine the priority in which casualties are treated.

b. Chemical poisoning, besides being difficult to treat in itself, will complicate the therapy for other conditions. The addition of antidote therapy may further complicate management of other conditions requiring drug therapy, e.g., use of muscle relaxants for surgery or the use of analgesics. Some of these drug interactions are currently unknown, and the medical staff must remain alert for unusual reactions to otherwise common therapy on the battlefield.

SECTION II - CASUALTY MANAGEMENT PHASES

1108. General.

a. *Field Medical Operations.* Field medical operations are conducted with several echelons of care, with increasing capabilities, and more sophisticated equipment towards the rear. The most forward medical support is usually provided by enlisted medical personnel with limited equipment, drugs, and medical capabilities.

b. *Far Forward Treatment.* Major advances have been made in casualty survival by advances in medical and surgical capability, and most importantly by advances in rapid evacuation and early stabilisation of casualties. On the chemical battlefield, early treatment and stabilisation will be particularly critical, since the lethal agents have very rapid onset of severe, life threatening effects. This means that far forward treatment, often by non-medical personnel, will be of even greater importance than in conventional warfare.

c. *Casualty Care Systems.*

(1) A specific example of a casualty care system is described in AMedP-7(A), Concept of Operations of Medical Support in a Nuclear, Biological and Chemical Environment. Because the mission requirements of each Service differ markedly, the organisation of medical support, the types and amount of medical resources at the echelons, and the evacuation distances between echelons will differ greatly. Further, there will be other national differences, such that the description of a particular system will not coincide with other national or Service systems.

(2) However, when the necessity of certain functional capabilities to handle different systems is considered, important similarities between the different systems can be identified. Nine functional phases of casualty care have been identified. Not every casualty will pass through all phases. Further, some phases such as evacuation, may be performed several times. Although the phases are arranged in order, the exact temporal order may vary from system to system, or be modified by force of circumstances. The first three phases, pre-attack, self aid and buddy aid will be carried out by non-medical personnel in the units themselves. The remainder of the phases will generally be carried out by medical personnel and units.

1109. Phase I - Pre-Attack.

a. The steps taken before an attack occurs will be the most important in determining how many and how severe the casualties will be. The protective mask and clothing are the first line of defence. Some nations have pre-treatments available for protection against certain chemical agents. Training will be essential to maximise protection of personnel and equipment. With multiple dose pre-treatments, strict discipline to ensure proper use will be necessary. The immediate commander exercises primary responsibility for ensuring that all necessary steps are taken. Medical personnel have a staff advisory role to the commanders in assisting them on matters of medical importance. For instance, commanders need to be advised of the physiological stress characteristics of the protective ensembles and how performance capabilities may be altered. The relation between environmental temperature and heat stress needs to be emphasised, especially in training situations, to avoid unnecessary heat casualties. Medical units will generally follow the same training and procedures for protecting themselves as do the non-medical units.

b. An example of possible guidance given for the prevention of heat casualties is given in Paragraph 1127. Each country may wish to issue its own specific guidelines.

1110. Phase II - Immediate Post-Attack/Self Aid.

a. The goal in this phase is to protect oneself from agent exposure during and immediately after an attack, to stop any further exposure, or to initiate immediate therapy if a significant exposure has occurred.

b. Since it is by definition “self care,” it is carried out only by personnel still capable of functioning. For agents with rapid onset, some personnel may not have time to take any steps before they are severely incapacitated and will by definition not pass through this phase. Since personnel in this phase will still be able to function to a certain degree, it is important that any treatment that they take not be incapacitating in itself. Some individuals will take such self aid mistakenly when they have not had a significant exposure, or even deliberately. Since the preservation of the unit effectiveness is most important at this point, additional casualties from the antidotes must be avoided.

c. The specific antidotes available for self care are discussed in the chapters for the different classes of agents, and are further prescribed in national and service doctrines. The specific steps in self-administration of the antidotes are likewise part of national and service doctrine and training. A critical factor in use of self aid antidotes is clearly defining the specific conditions under which they will be taken. Most commonly, they are taken when the individual notices a specific set of symptoms, characteristic for the agent. Additionally, self decontamination kits and their use are described in national and service doctrine.

1111. Phase III - Buddy Aid.

a. Buddy aid is the care given by non-medical personnel to personnel who are not able to care for themselves. Incapacition of various degrees is the marker differentiating between self care and buddy care.

b. Many units do not have medical personnel assigned or attached, or the medical personnel themselves may be casualties. Since immediate care is often so important in treating chemical casualties, buddy care will be the determining factor in the success of treatment. Unit commanders must take considerable care to ensure that all personnel have a adequate training to perform buddy care for chemical agent casualties. Such training is essential since the normal instinct of soldiers to help one another may be hampered by the inability in protective clothing to recognise that help is needed. Medical personnel may assist commanders in providing training.

c. Since the numbers of medical personnel are limited, particularly in forward units, commanders may wish to have a few non-medical personnel trained to a higher level of medical proficiency than would be feasible for all personnel. This could be valuable in resuscitation of nerve agent casualties for example, where the procedures are more complex. Such trained personnel would also provide back-up for medical personnel who may become casualties.

d. The antidotes available for buddy care will usually be the same as those provided for self aid. Since the casualty will be already incapacitated, the concern for further incapacitation from antidotes no longer applies, and further or higher doses of antidotes may be given if available. The individuals providing buddy care should not use their own antidotes to treat a casualty since they may need it themselves, but should use those belonging to the casualty, or any others available.

e. Commanders will have to exercise some control on buddy care, so as not to compromise mission accomplishment, but must also recognise their exclusive responsibility for the welfare of the casualties while they are still in the commanders' units. Manpower intensive procedures such as resuscitation must be applied judiciously, and only to those likely to benefit in order to avoid tying up too many personnel. Similarly, casualty evacuation out of the unit often requires the unit's own personnel initially and must be tightly controlled to retain personnel within the unit. Again, unit survival must be the overriding consideration.

1112. Phase IV - Initial Medical Care.

a. Initial medical care is the first care given by medical personnel. Although for administrative reasons medical care is sometimes defined as beginning when a casualty is treated by medical personnel, from a functional consideration medical care should be a continuous process, and this phase is a continuation of care given in preceding phases.

b. The goals of the initial medical care are to return to duty promptly all personnel still effective, and to stabilise and prepare for evacuation those casualties who require further medical care. Even though the medications, equipment, and medical personnel resources available far forward are limited, this phase will still be highly

critical for successful outcome. As a result of certain agents, casualties reaching this point may be severely incapacitated. Triage will be important in determining priorities of care and evacuation. The specific therapy available in this phase will depend on the unit, national and Service doctrines, and policies.

1113. Phase V - Life Support/Stabilisation.

Given the rapid onset and severe course of poisoning by some of the chemical warfare agents, nerve agents in particular, consideration for life support of vital, cardiovascular and respiratory function will often be required. Other conditions such as hemorrhage or shock from conventional wounds will also require immediate care. The ability to successfully manage these conditions will depend on the resources available at the various echelons. Triage criteria may dictate that some of these casualties will have a low priority of care. However, it is vital to make some effort to stabilise a casualty before evacuation to higher echelons and some effort at stabilisation should precede time consuming efforts such as full casualty decontamination. Therefore, some means of handling severe casualties should be incorporated early on in the system of managing casualties at each echelon. Hemorrhage, severe respiratory distress, cardiovascular collapse, shock, and seizures are among the conditions requiring prompt attention.

1114. Phase VI - Evacuation.

Evacuation of chemically injured casualties entails more than transportation. Monitoring is important to ensure that the casualty's condition is not deteriorating. Some provision for in transit care will also be critical. Since some casualties may be contaminated, the casualty evacuation system must be organised in a way as to minimise the spread of contamination. Since mass casualties may occur, and the number of medical vehicles may be inadequate to meet the increased load, unit commanders need to have contingency plans to supplement medical vehicles for casualty evacuation, or be prepared to retain casualties within their units for longer periods of time. Aeromedical evacuation is desirable when feasible, but the combat situation, the chemical environment and the possibility of contaminating helicopters may preclude their use far forward, in the initial stages of evacuation.

1115. Phase VII - Casualty Decontamination.

a. The goal of casualty decontamination differs from personal and unit decontamination. In addition to preventing exposure of the agent, casualty decontamination also has the goal of preventing exposure of medical care personnel and facilities to contaminated casualties. The requirement for casualty decontamination will be a function of the agent used, environmental factors, and particularly time. Liquid chemical agents on the skin may react with, or penetrate it rapidly. Some method of monitoring contamination would be valuable in determining the degree of decontamination required.

b. It is imperative that at least limited decontamination is performed as soon as possible. This will diminish the chance of recontamination of the casualty, or contamination of medical personnel and facilities from any agent left on the clothing or equipment.

Given the time it takes to evacuate casualties, the quantity of liquid agent on the skin or clothing will have diminished or even disappeared due to evaporation. Often careful removal of the clothing and equipment, with spot decontamination of skin areas that may be at risk of recontamination when the clothing is removed, will be just as effective as full decontamination, and can be accomplished more quickly and with fewer personnel. Protecting the wound from any further contamination with protective dressings is desirable. Further management of wounds should follow normal treatment procedures.

c. The hazard of off-gassing and further contamination from clothing and equipment removed from contaminated casualties requires that these items be disposed of properly. Several methods may be utilised for this purpose, such as impermeable bags or containers, or bleaching powders.

d. Disposal sites for these items must be marked in accordance with the standard NATO markings.

1116. Phase VIII - Definitive Care.

Specific therapy of the chemical casualty should be initiated as far forward as possible. It may occur across several echelons of care, involving increasingly sophisticated medical treatment as the casualty is evacuated to the rear.

1117. Phase IX - Disposition.

Following successful medical intervention, it must be decided whether a casualty should be returned to duty, held, or evacuated further to the rear for further treatment and convalescence. For casualties with minor exposures, it is desirable to return them to duty as soon as possible, and as far forward as possible, although this is not always operationally feasible. For casualties with severe poisoning, the course may be prolonged, and a long convalescence may be expected. The disposition of mustard injuries is dependent not only on the extent of injury, but also on the site of injury, as is described in Chapter 3. Care must be exercised in early mustard or phosgene injuries not to confuse the latent period with absence of injury. Nerve agent casualties with depleted cholinesterase levels are likely to be more susceptible to subsequent poisoning from nerve agents until their cholinesterase levels return to normal.

SECTION III - COMBINED INJURIES

1118. Introduction.

a. Combined injuries occur when a casualty is affected by conventional weaponry and also by the use of nuclear, chemical or biological weapons. The situation in which a casualty is contaminated with a chemical agent, but not suffering from such an agent's effects is dealt with in AMedP-7(B).

b. Wounds which are not contaminated should be dressed in the usual way. They should then be covered with agent proof material (either impervious material or material similar to that of the protective suit) and any pressure bandage considered necessary

may then be applied over the protective covering. These precautions may prevent the casualty becoming a mixed chemical and conventional casualty.

c. The object of this section is to consider the effect of poisoning by chemical agents, and the effect of drugs used in the treatment of such poisoning upon the handling and treatment of casualties who are suffering from conventional wounding. A summary of possible interactions is listed in Table 11-I.

Table 11-I. Potential Interactions of Chemical/Conventional Injuries

Chemical agent group	Potential interaction
Nerve agents (carbamate pre-treatment) (atropine)	Relaxants in anaesthesia. Resuscitation. Narcotic analgesics. Blood loss. Shock.
Vesicants (mustard and arsenicals)	Slow healing of wounds. Haematopoietic depression. Infection more likely.
Lung damaging agents	Resuscitation. Blood loss. Shock (latent period may be shorter).
Cyanogen agents	Resuscitation. Narcotic analgesics. Blood loss. Shock.

SECTION IV - NON PERSISTENT AGENTS

1119. Injury Complicated by Exposure to a Non Persistent Nerve Agent.

a. The dangers presented by this form of combined injury are those of the nerve agent itself, those of the interaction of respiratory depression with the conventional injury and those of the reduced cholinesterase activity upon drugs used in anesthesia during subsequent surgery; even carbamate pre-treatment may affect muscle relaxants to a limited extent.

b. Signs of nerve agent intoxication will call for treatment as described in Chapter 3.

c. Loss of blood will complicate respiratory failure, so that the administration of oxygen, if available, and positive pressure resuscitation if necessary, should be applied at the earliest indication of need. The need for replacement of blood lost through conventional injury will be correspondingly greater if respiratory depression is present. Reduced cholinesterase activity will affect the use of relaxant drugs used during anesthesia. On basic principles the action of anticholinesterases (including

to a lesser extent pyridostigmine pre-treatment) may be expected to potentate the action of depolarizing relaxants (e.g., succinylcholine) prolonging their action, but to oppose the action of non-depolarising relaxants of the curare type increasing the necessary dose. Drugs, such as opiates and other drugs, which reduce respiratory drive should be used with caution in cases of nerve agent intoxication.

1120. Injury Complicated by Exposure to Lung Damaging Agents.

a. This form of combined injury increases the stress element involved in the induction of pulmonary oedema. The latent period between exposure and the development of pulmonary oedema may possibly be shortened and the pulmonary oedema itself may be more severe.
b. The casualty should be kept at rest as far as possible during evacuation and steroid treatment if used should be applied at the earliest moment. There is no contra-indication to the use of opiates or other systemic analgesics in order to treat pain or shock from the conventional injury. Oxygen therapy may be required, but fluid replacement should be used with caution. The final decision on the necessity for fluid replacement must be made on the basis of the casualty's condition, bearing in mind the danger of precipitating or increasing pulmonary oedema.

1121. Injury Complicated by Exposure to Cyanogen Agents.

a. Combined injuries of this type will present especial danger from respiratory depression and from the therapeutic reduction of the oxygen carrying power of the blood, owing to the formation of methaemoglobinaemia in treatment.
b. The need for treatment of cyanide poisoning is urgent and must be started in accordance with Chapter 5. Oxygen therapy together with positive pressure resuscitation may be required all the more urgently in the presence of marked hemorrhage.
c. Opiates and other drugs which reduce respiratory drive must be used with caution in these combined injuries as the respiratory centre is depressed in cyanide poisoning.

SECTION V - PERSISTENT AGENTS

1122. Injury Complicated by Persistent Nerve Agents.

a. Where the conventional injury is itself contaminated by a persistent nerve agent the danger of the casualty absorbing a lethal dose of nerve agent through the wound is very great and the prognosis is correspondingly bad. Although the wound track resulting from a conventional weapon injury in surrounded by devitalised tissue, there is rapid penetration of the tissues by nerve agent and a lethal dose may be quickly absorbed especially if a persistent agent contaminates the wound.
b. Decontamination of the skin surfaces around the wound should be carried out and then a surface dressing applied. The wound itself should be protected from further contamination and the integrity of the suit restored. Wounds may be irrigated using

a solution of hypochlorite and then flushed with normal saline. Hypochlorite should not be used, however, within the abdominal or thoracic cavities, nor with intracranial wounds. Early surgical excision of the contaminated wound may offer the best chance of success but autoinjector treatment should be started immediately the wound contamination is diagnosed and repeated as necessary.

c. Surgery of the contaminated wound offers minimal danger to medical and nursing staff if gloves made of butyl rubber are worn. If these are not available then two pairs of latex rubber gloves should suffice if washed at short intervals in hypochlorite solution and changed frequently. The evacuation of casualties with combined injuries requires careful observation while on route to a surgical unit and autoinjector treatment continued if signs of poisoning persist or worsen.

d. For conventional wounds not directly contaminated but with the surrounding skin affected by a chemical agent, decontamination of the skin should be carried out and any poisoning treated as appropriate for the particular agent involved.

e. Where the conventional injury is not directly contaminated, but skin absorption is thought to have occurred, skin decontamination should be carried out in the recommended way. Any signs of nerve agent intoxication should be treated. The casualty should be kept under as close observation as circumstances allow in case signs of delayed absorption of agent appear. If it is necessary to evacuate without medical supervision, consideration may be given to the use of one injection from the automatic injection device as a precaution against delayed absorption of nerve agent.

1123. Injury Complicated by Contamination with Vesicant Agent.

a. Vesicant agents will debilitate the casualty and may seriously delay the healing of any wound due to systemic effects, even if the wound itself is not directly contaminated. A contaminated wound will be very slow to heal and may also lead to rapid systemic absorption of the agent.

b. If the contamination of a wound with Lewisite occurs (immediate pain, disproportionate to the severity of the wound is suggestive of this) therapy with dimercaprol (BAL) will be required at an early stage.

c. The area around the wound should be decontaminated and the wound dressed. The dressed wound should be protected from further contamination with material similar to that of the protective suit.

d. Thickened mustard may be carried into wounds on fragments of cloth. These wounds should be carefully explored using a no-touch technique. Fragments of cloth should be removed and placed in a bleach solution. This removes the hazard from mustard vapour off-gassing. Wounds should be irrigated using a solution containing 3000-5000 ppm free chlorine (dilute “milton” solution) with a dwell time of approximately 2 minutes. The wound should then be irrigated with saline. This technique should not be used in the abdominal, or thoracic cavities, nor with intracranial head injuries.

e. Opiates should not be withheld if the condition of the casualty calls for their use.

SECTION VI - OTHER CONSIDERATIONS

1124. Collective Protection.

Collective protection greatly enhances the treatment of casualties in a contaminated environment as 15-30% of casualties can not be adequately treated without removal of their respirator.

1125. Head Wounds.

Head wounds, after being attended to and dressed will necessitate the casualty being evacuated in a casualty bag or half bag or hood. In emergency the casualty's head may be protected in a pervious blouse from a spare protective suit.

1126. Heat Stress.

a. The use of individual protective equipment and casualty bags imposes a significantly greater heat stress upon the individual. In warm environments and at moderate work rates personnel are susceptible to heat injury.
b. The medical officer's responsibilities may include providing advice to commanders about work/rest cycles and of the need for increased fluid intake.
c. Medical attendants need to be especially aware of the need to replace fluids in casualties wearing individual protective equipment.
d. Protective equipment makes monitoring casualties difficult and a high index of suspicion for heat stress must be maintained at all times.
e. Table 11-II may be applied as guidance for the prevention of heat casualties in acclimatised individuals. In situations where work is heavy or prolonged, the risk of heat injury exists at wet bulb gradient temperatures (WBGT) below 78°F (25.5°C).

Table 11-II. Heat Casualty Prevention Guide

Heat condition (category)	WBGT index* (°C)	Water intake (liters per hour)	Work/rest cycle (minutes)	WBGT index* (°F)	Water intake (US pints per hour)
1	25.5 to 27.6	At least 0.45	Continuous	78.0 to 81.9	1
2	27.7 to 29.3	At least 0.45	50 / 10	82.0 to 84.9	1
3	29.4 to 31.0	At least 0.9	45 / 15	85.0 to 87.0	2
4	31.1 to 32.1	At least 1.4	30 / 30	88.0 to 89.9	3
5**	32.2 and above	More than 1.8	20 / 40	90.0 and above	More than 4

* Individual protective gear or body armour adds at least 6°C (10°F) to the WBGT index.
** Suspend physical training and strenuous activity. If operational mission (non-training) mission requires strenuous activity, enforce water intake to minimise expected heat injuries.