

HOME OFFICE  
CIVIL DEFENCE  
TRAINING MEMORANDUM No. 3

**The Control of Civil Defence Operations**  
**under**  
**Fall-out Conditions**  
**(England and Wales)**

LONDON  
HER MAJESTY'S STATIONERY OFFICE  
1959: Reprinted 1964  
SIXPENCE NET

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## *Control of Civil Defence Operations under Fall-out Conditions*

### **Fresh Data on Medical Effects of Radiation**

- 1 Following a fresh appraisal of the hazard of radioactivity as it affects civil defence operations, a number of major changes are necessary in the doctrine of deployment and use of civil defence forces in areas affected by radioactive fall-out. This reappraisal indicates that:
  - (a) in the lower dose range the immediate effects of gamma radiation are less serious than has been previously supposed;
  - (b) in the higher dose range the effects are slightly more serious than previously supposed, the 50 per cent lethal dose being rather lower;
  - (c) the advantage to operational forces to be gained by spreading the accumulation of the dose over a period of days is not so great as previously supposed.

It is also suggested that because of the steep rise in the dose sickness curve from about 150r. this figure may be regarded as a dividing line. It may be accepted that a dose below 150r. would not have any immediate effect which could interfere with vital life-saving operations.

### **Wartime Emergency Dose**

- 2 In considering the permissible dose for civil defence forces it is necessary to balance the operational gain against the medical consequences, both short and long term, to the forces engaged. It should also be remembered that both the rescuers and the rescued might well have to continue to live in areas of low, but none the less significant, residual radiation.
- 3 With these considerations in mind, it has been decided that the wartime emergency dose should be fixed at 75r. and should apply to all the services and persons engaged in the conduct of life-saving operations whether in a damaged or undamaged area (e.g. in the clearance of a "Z" zone). In arriving at this figure the following factors have been taken into account:
  - (a) Variations of susceptibility between individuals and the possibility of instrumental errors and of unexpectedly high doses encountered at work or in transit. 75r. is therefore considered to be the highest planning figure that can be accepted if sickness is to be prevented with any certainty.
  - (b) An increase in the dose would not bring proportional operational advantages, though it would increase in direct proportion the risks, both short and long term, to the forces engaged.
  - (c) Those forces will include units of all the disciplined services, army, police and fire service as well as the Civil Defence Corps and Industrial Civil Defence Service, on whom reliance will have to be placed during the 'survival' period following attack.
  - (d) Whatever planning dose is accepted some margin must be allowed for it to be exceeded at discretion (see paragraphs 4 and 5 below).



### Discretion to Exceed Dose

- 4 Where exceptionally it became necessary to complete a task already in hand and no relief was available, unit commanders would have discretion to exceed the wartime emergency dose of any of the forces under their control, up to a maximum of 100r. and no more.
- 5 Subject to the situations mentioned in paragraph 4 above, the Regional Commissioner alone would have power to authorise a higher dose than 75r. for all or any part of the forces engaged. The case for increasing the dose for any particular forces would be properly assessed and presented by the Sub-region or Group Controller, or by the regional representatives of services. But the responsibility for making the decision would always rest with the Regional Commissioner.

### Working Lines and Shifts

- 6 In the light of the new medical data recorded in paragraph 1(c) above, it is no longer considered to be material whether the wartime emergency dose is taken in a single exposure or several exposures. The crucial issue is the relative advantage of using up the dose in a short period of early and deep penetration into areas of high radiation as against a longer working period in areas with lower dose rates. The balance of advantage would differ according to the nature of the work; but for the rescue and casualty services it is thought that the best results would be obtained from working at or about a dose-rate of 10 r.p.h., so that the wartime emergency dose was used up in a single shift of about 8 hours. This does not imply that 8-hour shifts should be rigidly adhered to: units would have to continue to work until their wartime emergency dose was expended, allowing some further dose in withdrawing, or it was considered desirable and possible to relieve them by fresh forces. Some forces, e.g. ambulances, could operate profitably where their dose was spread out over longer periods than 8 hours by working at lower dose-rates than 10 r.p.h. Others, e.g. reconnaissance parties with special responsibility for rapid penetration, might have to take their wartime emergency dose without heed to the 10 r.p.h. line and reduce their working period accordingly.
- 7 In the early stages of fall-out, before the maximum had been reached and it became possible to plot contours, the Controller would wish to know the limits of the area within which fall-out was coming down. At this stage his map should, if possible, show a single line marked F.O.L. (fall-out line) to indicate the outer limit of posts from which fall-out readings, however small, were reported.
- 8 Subsequently, as the information became available, the Controller's map would show the 10 r.p.h. (red) line at progressive intervals of time, say at H+1, also at the time when the main deployment of forces is calculated to start and at 8-hourly intervals thereafter. This line would serve as a convenient indication to the Controller of where forces could best be deployed, but must not be regarded as a barrier identifiable on the ground, beyond which forces must not penetrate. Once committed, units would continue with the task as it opened up, with reference only to the total dose accumulated on their dosimeters.

- 9 There will also be marked on the Controller's map an inner operational line indicating the limit of life-saving operations possible in the damaged area within the first 48 hours. This may be set by high radiation dose-rates, or impenetrable fire or debris, or a combination of all three. The radiological limit should be taken as the 1,000 r.p.h. at H+1 contour which will be 10 r.p.h. line at H+48 and so mark the limit to which life-saving forces can be expected to have penetrated by that time. The position of the inner operational line will be first estimated on reports received from home cover forces or from reconnaissance parties sent in from outside; and checked and corrected as further information is received during the course of operations.

#### **Deployment Principles: Sub-region and Group**

- 10 It must be assumed that where a Sub-region or Group has suffered attack the Controller will have full use of all his forces, subject to any specific instructions to the contrary that may be received from Region. As a general practice Region will not create a reserve in anticipation of attack by keeping a proportion of Sub-regional or Group forces at its own disposal; but will do so after attack by drawing reinforcements from areas that have escaped or are least affected.
- 11 After attack, the first duty of a Sub-regional or Group Controller must be to estimate the task confronting each of the Areas in the Sub-region, the time in which that task ought to be completed, and the forces which the Area Controllers will require to accomplish it in that time. Full and reliable information is likely to take many hours to come in, so that if deployments are to be ordered and reinforcements sought promptly it will be necessary to act first on estimates. Although these can be approximate only, they should nevertheless provide a reasonable basis for initial action pending the arrival of firm information by which they can be corrected and adjustments made (see paragraph 20 below).
- 12 The task will be set by the number of casualties trapped, or seriously injured but untrapped, outside the inner operational line and capable of being succoured within the first 48 hours. As soon as possible after ground zero, weight and nature of attack are known the Controller should have casualty estimates made and plotted by Sectors. This will be done by applying to the population figures for the Sectors casualty percentages as shown on the graph (from Exercise ARC) attached as an appendix to this memorandum, which sets out, on the best evidence at present available, the proportions of seriously injured, trapped and untrapped, to be expected at different distances from ground zeros of bombs of varying power.
- 13 In accordance with the general principle that casualty forces should be deployed so as to keep pace with the contracting 10 r.p.h. line, the time by which the task should be accomplished (resources permitting) will be the time when the 10 r.p.h. line and inner operational line coincide. If radiation is the limiting factor this will be at H+48 (see paragraph 9 above), but if the inner operational line is determined by impenetrable fire or debris it may well be earlier.
- 14 The number of forces which Area Controllers will require to accomplish the task by this time will be obtained by adopting the following estimates of



output. These estimates are necessarily assumptions, but are based on the best information at present available. For convenience the figures are related to 8-hour shifts.

- (a) A single Forward Medical Aid Unit can be expected to deal with about 120 seriously injured an hour—say 1,000 in each shift—and to continue working throughout the operational period with only internal reliefs. The F.M.A.U. requirement can therefore be assessed by dividing the total of seriously injured, trapped or untrapped, by the expected number of shifts multiplied by 1,000. For example, if the seriously injured are estimated at 15,000, and the work is expected to be complete in five shifts, the number of F.M.A.U.s. required will be 3; but if the 10 r.p.h. line and inner operational line are estimated to coincide at, say, H+28 so that the task should be completed in three shifts, the number required will be 5. For every two or three F.M.A.U.s. required on this estimate one extra should, however, be added to allow for some variation of requirements between different shifts, to help in providing relief staffs, and to deal with the increasing accumulation of moribund persons held at the F.M.A.U.s. as operations progress.
- (b) At the beginning of operations a 4-berthed ambulance can be expected to take about 1 hour on the round trip from ambulance loading point to F.M.A.U. and back. Therefore each F.M.A.U. will require 30 ambulances on the forward shuttle. At this stage an F.M.A.U. may be expected to send to hospital about three-fifths of the seriously injured it receives—say 75 an hour. Allowing rather more than 2 hours for the round trip from F.M.A.U. to hospital and back about 40 ambulances will be needed to clear this number.  
On this calculation each F.M.A.U. should be accompanied by 70 ambulances. As operations progress, however, debris obstruction and road congestion are likely to increase the time taken by ambulances on the forward shuttle, but as the rate of moribund persons increases proportionately fewer people will be transported from F.M.A.U. to hospital. Although these factors will tend to cancel each other out, nevertheless the total ambulance requirement may be increased from, say, 70 to 90 ambulances per F.M.A.U. It must therefore be assumed that the ambulance requirement will increase by, say, 20 per cent over the course of operations.
- (c) A single casualty collecting party can handle and send to ambulance loading points about 12 seriously injured an hour, or, say, 100 per shift. Ten casualty collecting parties will therefore be required on each shift to keep a single F.M.A.U. served. The number of shifts each casualty collecting party can undertake will depend entirely on the degree of fall-out. In fall-out conditions where parties will be working consistently on or about the 10 r.p.h. line, each party will be able to undertake only one shift before using up its wartime emergency dose. At the other extreme there may, however, be circumstances in which there is no significant fall-out, in which case a party might be expected to work shift and shift about—say, for three shifts during an operational period of 48 hours. Within these limits it will be for the

scientific advisers to assess the requirement in the light of the general radiological situation prevailing.

- (d) A single rescue party can release two or three trapped persons an hour or, say, 20 per shift. The number of party/shifts can therefore be estimated by dividing the number of trapped by this figure. The number of shifts each party can undertake will be governed by the same considerations as apply to casualty collecting parties.

- 15 The calculations set out above should enable the Controller to assess broadly how far the forces held by each Area measure up to the task confronting it; in the light of that assessment either to redispense forces between Areas or to adjust Area boundaries and to estimate the reinforcements required from Region.
- 16 No general rule can be laid down whether it is preferable to redispense forces between Areas to match the tasks, or to alter Area boundaries so as to make the tasks match resources. The overriding consideration is likely to be access to the damaged area from the respective Operational Bases. Subject to that, it can be said that the alteration of Area boundaries would have the advantages that it could be used to even out the tasks falling upon the various Area controls, would enable forces to be employed under their own Controllers, and would reduce lateral movements between Operational Bases with their attendant traffic problems. Too frequent use of this device might well, however, cause confusion: to the extent that boundaries were altered Controllers and senior officers would find themselves operating in unfamiliar territory. In practice it is probable that both methods may have to be employed to some degree, and that the choice will be dictated less by theoretical considerations than by the inescapable facts of the situation.

#### **Deployment Principles: Area**

- 17 Each Area Controller should prepare his own casualty estimates on the same data as, but independently of, the estimate prepared by Sub-region or Group and these should be plotted by warden post areas.
- 18 The Area Controller should deploy the forces put at his disposal on the following general principles:
  - (a) He should determine the earliest time at which the deployment of rescue and casualty forces can start (say  $H+t$  hours). This will be when the dose-rate at the outer-most place where there are a significant number of casualties, falls to 10 r.p.h. (or if there is no significant radioactivity as soon as that fact is established).
  - (b) He should next estimate where the 10 r.p.h. line will be at the end of an 8-hour shift (i.e. at  $H+t+8$  hours) disclosing the size of the casualty task then uncovered.
  - (c) He should estimate the number of units necessary to complete this task in accordance with the data given in paragraph 14 above and order these forces into action. If the size of the task warrants it, e.g. because radioactivity is light, he should not hesitate to commit a major part, or indeed all, of the forces immediately available to him on the first shift.



(d) He should continue to estimate what forces will be required on successive 8-hour shifts to keep pace with the 10 r.p.h. line as it contracts with radioactive decay, and report to Sub-region or Group if it appears that forces available will be inadequate for the task, or will exceed the requirement.

- 19 In ordering forward his forces, one of the first tasks of the Area Controller should be to decide where his F.M.A.U.s. are to be sited. In order to conserve ambulance resources and get casualties to medical attention as soon as possible, the object should be to site the F.M.A.U.s. as far forward as suitable surviving buildings can be found outside the area of significant radioactivity, fire and damage, and on the fringe of the main casualty belt. Once again no absolute rule can be laid down but suitable conditions may be found at distances from ground zero varying from about 11 miles in the case of a 10 megaton bomb, to 8 miles with a 4-megaton bomb, and 5 miles with a 1-megaton bomb.
- 20 As operations progress, information will come in to Area Control confirming or amending the initial estimates, both of the extent of casualties and of the output of the forces engaged. The flow of casualties through the F.M.A.U.s. will provide a valuable barometer of this, but the progress made by the casualty collecting and rescue parties will be the chief criterion. To the extent that casualties have been under-estimated or the output of the forces over-estimated the parties will tend to fall behind the contracting 10 r.p.h. line: if, on the contrary, the estimates have proved too pessimistic they will overrun it. It will be the responsibility of Area Control to redress the balance by ordering forward proportionately more, or fewer, forces in subsequent shifts.
- 21 As a result of these adjustments, Area Control is likely to find that it requires either more or fewer forces than have been put at its disposal, and it should at once report this to Sub-region or Group, which in its turn will be responsible for re-adjusting the balance, either by a redistribution of forces between Areas or by increasing or reducing the demands made on Region for reinforcements. Both at Area and Sub-region or Group a close and continuing watch must be kept on the situation as it develops.

#### **Inadequacy of Forces**

- 22 With the best disposal of forces between Areas, and despite regional reinforcement, it may very well be found that forces available are insufficient to the task so that operations have to be prolonged beyond the period when they should theoretically be completed (see paragraph 12 above). An insufficiency of resources at any one point may slow down the whole operation. In so far as the deficiency is in the number of casualty collecting or rescue parties there is little that can be done; unless in the first case, there are rescue parties that can be diverted to casualty collecting work, or in the second, it is decided to increase the output of the parties by concentrating only on those trapped persons who can most speedily be released; or in either case the Regional Commissioner is prepared to sanction an increase in the war-time emergency dose and so enable parties to be employed for further shifts—and this is by no means to be assumed. Where, however, the deficiency is in



the number of ambulances or F.M.A.U.s. some remedial action can be taken on the lines described below.

23 If there is a deficiency of F.M.A.U.s., casualties will tend to accumulate as they arrive at the reception site of those F.M.A.U.s. that are deployed. Some such accumulation might be accepted without halting the progress of casualty collecting or rescue parties provided:

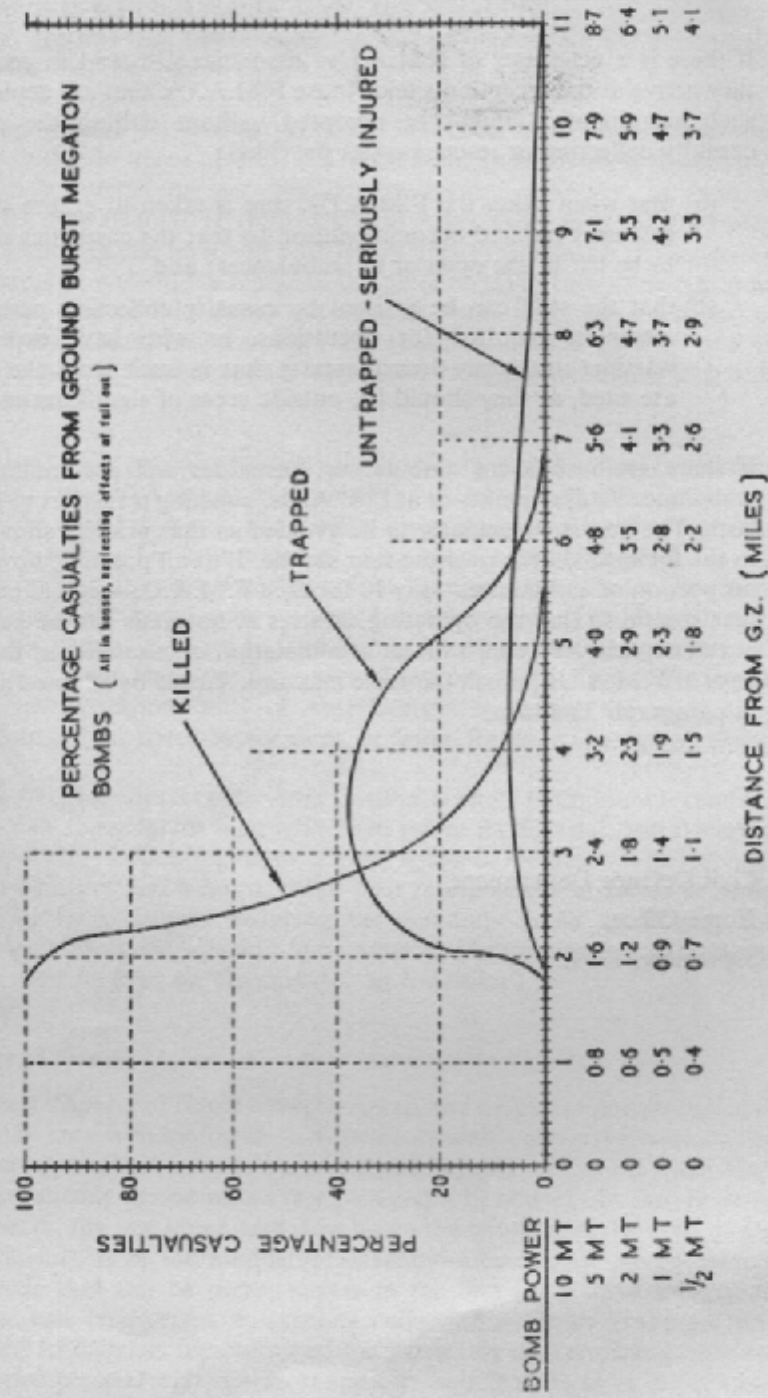
- (a) that when siting the F.M.A.U.s. care is taken to ensure that there is sufficient covered accommodation so that the casualties do not have to be left in the open or in ambulances; and
- (b) that the staff can be assisted by casualty collecting parties not immediately required for operations, or who have expended their wartime emergency dose assuming that in such cases the F.M.A.U.s. are sited, as they should be, outside areas of significant radioactivity.

24 If there are insufficient ambulances, casualties will accumulate either at ambulance loading points or at F.M.A.U.s. awaiting transport to hospital, or both. The first is particularly to be avoided so that priority should be given to the forward shuttle over the rear shuttle. If at all possible, however, some proportion of ambulances—say 10 for each F.M.A.U.—should be left on the rear shuttle so that the operating theatres at hospitals can be kept working at full capacity. To deal with an accumulation of casualties at the discharge bays of F.M.A.U.s., much the same measures should be adopted as described in paragraph 23 above.

Civil Defence Department,  
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# APPENDIX

## EXERCISE ARC







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