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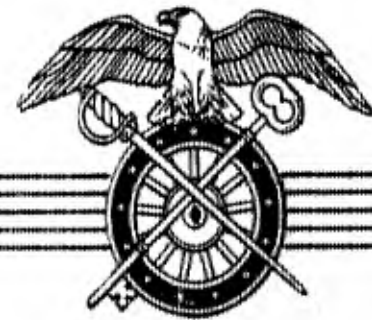
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GRAVES REGISTRATION OPERATIONS UNDER CONCEPTS OF FUTURE WARFARE

This study reflects only the views of the Quartermaster Board and does not necessarily represent those of USCONARC or the Department of the Army.

MARCH 1962



QUARTERMASTER BOARD, U.S. ARMY
FORT LEE, VIRGINIA

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QUARTERMASTER BOARD
UNITED STATES ARMY
FORT LEE, VIRGINIA

IN REPLY
REFER TO: QMB-RS

1 May 1962


SUBJECT: QMCCD 56-9, Graves Registration Operations Under Concepts of
Future Warfare

TO: Commanding General
ATTN: Combat Developments
US Continental Army Command
Fort Monroe, Virginia

1. The final report of subject study is forwarded for review. The Quartermaster General has approved the study as completing the requirements of paragraph 1410b(4)(d) of the Department of the Army Combat Development Objectives Guide.

2. The study presents a concept for graves registration operations in support of future warfare with the emphasis placed upon the handling of remains from the forward area of the combat zone to the field army cemetery. For limited warfare, the study finds that the present system of graves registration support is basically sound and suitable and requires only minor changes. However, general warfare employing mass destructive weapons will require substantially increased GRS support. To meet this situation, the study points out changes which will be necessary in military policy, doctrine, organization and training. The study also identifies appropriate requirements for research and materiel development.

1 Incl
as


HERBERT H. RASCHE
Colonel, QMC
Acting President

PREFACE

So live, that when thy summons comes to join
The innumerable caravan, which moves
To that mysterious realm, where each shall take
His chamber in the silent halls of death,
Thou go not, like the quarry-slave at night,
Scourged to his dungeon, but, sustained and soothed
By an unfaltering trust, approach thy grave
Like one who wraps the drapery of his couch¹
About him, and lies down to pleasant dreams.

1. Excerpt from "THANATOPSIS" by William Cullen Bryant.

FOREWORD

Graves registration service in support of the army in the field provides for the search, recovery, and evacuation of deceased military personnel; the initial identification and temporary disposition of the remains; the recovery and handling of personal effects found on the remains; the establishment, operation, and maintenance of temporary military cemeteries; and the accomplishment of pertinent records and reports in connection with such activities.

During past conflicts, procedures have been developed to accomplish the above tasks which have proven workable and efficient and which are generally acceptable to tactical commanders and the public. This study considers the application of these procedures under concepts of warfare in the future and proposes changes where such changes appear to be necessary.

The greatest changes in policy and procedures will be required in the event of nuclear warfare, or warfare involving the use of chemical and biological agents, resulting in mass casualties. Warfare of this nature may preclude handling of remains as we would like to and force adoption of procedures which will not be acceptable in conventional warfare. What at first glance may seem callous and repugnant proposals in this study, will, upon serious reflection, be recognized as the best that can be accomplished in terms of realism and military necessity.



HERBERT H. RASCHE
Colonel, QMC
Acting President

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SUMMARY

GRAVES REGISTRATION OPERATIONS UNDER CONCEPTS OF FUTURE WARFARE (QMCGD 56-9)

1. Mission of GRS. Graves registration service in support of the army in the field provides for the search, recovery, and evacuation of deceased military personnel; the identification and temporary disposition of the remains; the recovery and handling of personal effects found on the remains; the establishment, operation and maintenance of temporary military cemeteries; and the accomplishment of pertinent records and reports in connection with such activities.
2. Scope of the Study. (Abridged) This study develops a concept for graves registration operations in support of future warfare. It is recognized that future wars may be fought with conventional type weapons or they may involve the use of mass destruction weapons resulting in mass casualties. The application of present policy and procedures to future tactical concepts is considered and changes are proposed where such changes are considered necessary. As a policy, standard GRS policies and procedures will continue to be applied and remains will be recovered and handled with the fullest reverence and in accordance with our best traditions to the maximum extent permitted by circumstances and military necessity.
3. Search and Recovery. In conventional warfare, initial search and recovery of remains will normally be done by the unit sustaining the loss to the extent that the unit's tactical mission permits. In warfare involving the use of chemical, biological, or nuclear weapons the unit sustaining the loss will probably not be able to recover the remains because of contamination or the necessity for immediate withdrawal from the battle area. Under these conditions search and recovery procedures will be conducted by quartermaster GRS personnel in the post-battle phase of operations. If the area is contaminated, recovery must be delayed until it is safe to enter the area. This may be from a few hours to several months or longer.
4. Evacuation. When conventional type weapons are being employed, evacuation of remains from point of recovery to the quartermaster GRS collecting point, normally established in the brigade trains area, will be done by tactical units. The unit sustaining the loss (company) will evacuate remains to the next higher tactical echelon (battalion) if this action will not interfere with its primary mission. If it is not feasible for the company to evacuate remains, the service element of the battalion will evacuate from point of recovery to the quartermaster collecting point at brigade level. Evacuation from the brigade collecting point to the army rear area is the responsibility of quartermaster GRS organizations. In the event recovery is done by GRS personnel, evacuation of the remains from point of recovery to point of disposition will also be done by GRS personnel.

5. Identification. There is a requirement for a quick, simple, positive means of identifying remains even if recovery is delayed for a considerable period. Identification is a serious problem even in conventional warfare and will be impossible in the event of mass casualties if an improved means is not developed. Possible solutions, as discussed in the study, may be to place a permanent identifying symbol on a major bone in the body or on the buccal surfaces of posterior teeth.

6. Disposition. Once remains are recovered, disposition will be accomplished either by immediate evacuation from the theater or temporary interment in army cemeteries. This will be the normal procedure but it may not be feasible to accomplish if mass casualties are sustained. The use of mass casualty (CBR) weapons may result in a volume of remains that precludes the possibility of normal identification and evacuation and reduces the problem to one of capability, expediency and sanitation rather than graves registration. Under such conditions the only possible procedure may be burial in mass graves using mechanical earth moving equipment, when nuclear contamination has subsided to safe levels.

7. Personal Effects. Personal effects will be returned to the next of kin, as in the past, but the problem will be aggravated by possible contamination. Contaminated effects must be monitored to determine if they are hazardous. Generally, if contaminated personal effects are retained at the Effects Depot for 60-90 days, they will become safe to return to next of kin. Positive command action should be taken to limit the number of personal items an individual may take to a theater of operations or acquire while there.

8. Organization and Training. Changes in present organization for GRS support at the direct support and general support levels are not proposed, although substantial personnel augmentation will be required by all GRS units in the event of CBR warfare. At division level it is proposed that the GRS unit be made an organic element of the division in the same status as any other essential combat or logistical support unit. GRS specialists, in addition to normal training, must be trained in the proper use of CBR detection equipment to permit monitoring of contaminated remains and personal effects and in decontamination methods and protective measures. All combat troops should be given minimum instruction in basic search and recovery techniques and proper handling of personal effects.

9. Main Conclusions. It is concluded that:

a. The GRS support system developed during two world wars and the Korean War is sound and workable and will require only minor changes to effectively support future conventional warfare.

b. Under CBR warfare, significant changes in GRS policy and procedures will be required:

(1) Because of tactical conditions and contamination involved, combat units generally will be unable to recover, identify and evacuate their dead. It will have to be done by GRS units.

(2) Remains will have to be left lying in contaminated areas perhaps up to several months, depending upon agent employed and intensity of contamination, until it becomes safe for recovery personnel to enter the area. This applies mostly to nuclear contamination (see annex B).

(3) Mass deaths can be expected to be a frequent occurrence. This will necessitate burial on the battlefield in mass graves.

c. Identification of remains is a most difficult problem in GRS operations unless identity is established immediately following death. Under most CBR warfare conditions, immediate recovery and identification will not be possible. An improved, simple, positive means of identification is required.

d. The present concept of furnishing necessary GRS personnel to the division on an augmentation basis is unsound and should be discontinued. The GRS platoon should be an organic element of the division in the same status as any other essential logistical or combat support unit.

e. No reliable estimate of overall CBR casualty rates can be made. It is considered that they will be substantially higher than those for conventional warfare.

10. Main Recommendations. It is recommended that:

a. Military policy recognize that mass deaths will tend to be a frequent and normal occurrence in CBR warfare and will force a requirement for mass burials on the battlefield with a minimum of conventional GRS procedure.

b. A research project be established to develop a quick and positive means of identifying deceased personnel, particularly in mass death occurrences. Research should include, but not be limited to, a means of placing a permanent identifying symbol on: 1) a major bone in the body that could be read and recorded quickly with a hand X-ray (or similar type) device on the battlefield; or 2) buccal surfaces of posterior teeth.

c. Military policy and doctrine be modified regarding responsibility of unit commanders for initial recovery and evacuation of remains to relieve them of the mandatory nature of this responsibility when prevented from accomplishing this task by the tactical situation.

d. All troop units receive, as part of their unit training, instruction in search and recovery procedures and the importance of safeguarding personal effects.

e. Provision be made for providing GRS support for CBR warfare by expansion of current GRS elements, at the DS and GS level, with the addition of sufficient technical augmentation cells, and supporting labor, and by the additional equipment, methods, and specialized training recommended in this study.

f. GRS elements of current and future divisions be authorized as an organic unit of the division rather than on an augmentation basis.

g. The following items of equipment be developed and furnished GRS units as required:

(1) A lightweight, disposable, wrap or sheet to shroud and seal remains during evacuation.

(2) A device to facilitate movement of remains from point of recovery to evacuation vehicles, and within the army cemetery, such as the Army Medical Service's proposed lightweight rollagon-type litter carrier.

(3) A light, simple, durable, portable hand X-ray (or similar type) device to provide for instant reading and automatic recording of the bone imprint or tooth marking identification through clothing and flesh. This item should be developed concurrently with the marking techniques proposed in paragraph b above.

h. Appropriate AW and CW detection and measuring equipment now available or under development be provided to GRS units for monitoring contaminated remains, personal effects, and GRS personnel.

i. Commercially available, mechanical earth moving attachments (of the back-hoe type) for use on organic vehicles be made organic to GRS cemetery platoons for use in digging graves or trenches at army cemeteries.

HEADQUARTERS
DEPARTMENT OF THE ARMY
OFFICE OF THE QUARTERMASTER GENERAL
WASHINGTON 25, D. C.

QMGPO-C

14 August 1961

SUBJECT: Combat Development Study Directive: "Graves Registration Operations Under Concepts of Future Warfare, QMCCD 56-9"

TO: President
Quartermaster Board, US Army
Fort Lee, Virginia

1. General. The Quartermaster Board, US Army, will conduct a study to develop a concept of graves registration support for the future army in the field. The study will be in consonance with the general objectives stated in paragraph 1410b(4)(d), Combat Development Objectives Guide.

2. Objectives and Scope. To develop policies and guidelines for organization, procedures, and materiel, with regard to recovery, identification, evacuation, and burial of deceased troops under concepts of future warfare in the army in the field in the 1966-1971 period. The study will consider implications of mass casualties, effects of contamination (from nuclear explosions, CBR Warfare, and other causes), handling of personal effects, reporting procedures, and return of remains program.

3. References:

a. US Army War College Study, ARWC 59-3, "Very Long Range Strategic Forecast", 31 December 1959.

b. US Army War College Study, ARWC 60-1, "The Role of the Army in Future Warfare", 30 June 1960.

c. Office of The Quartermaster General, "Graves Registration, Automatic Data Processing System Study", June 1960.

d. QMC Historical Studies, Number 21, "The Graves Registration Service in World War II", April 1952.

e. Appropriate Technical Service Long Range Forecasts.

14 August 1961

SUBJECT: Combat Development Study Directive: "Graves Registration Operations Under Concepts of Future Warfare, QMCCD 56-9"

- f. AR 638-30, "Graves Registration Organization and Functions in Support of Major Military Operations", 7 March 1956.
 - g. AR 638-40, "Deceased Personnel, Care and Disposition of Remains", 28 April 1959.
 - h. AR 643-55, "Disposition of Personal Effects", 2 June 1961.
 - i. FM 10-17, "QM Organization and Service in the Army and Corps", February 1952.
 - j. FM 10-63, "Handling of Deceased Personnel in Theaters of Operations", July 1959.
 - k. FM 27-10, "The Law of Land Warfare", July 1956.
 - l. TM 10-286, "Identification of Deceased Personnel", March 1956.
 - m. FM 10-3, "QM Direct Support Battalion", January 1961.
 - n. FM 10-4, "QM General Support Battalion", June 1961.
 - o. CGSC Study, CGSC 61-8, "Army Organization for the Period 1965-1970" (U) (in process).
 - p. CGSC Study, CGSC 62-2, "Long Range Reorganization Objectives Administrative Support Theater" (U) (in process).
 - q. US Army War College Study, ARWC 60-2, "Visualization of Theater Operations" (U), 25 May 1961.
4. Guidance.

a. The study will evaluate current concepts of graves registration service and isolate the major problems that are likely to develop in providing graves registration service to the Army in the field under conditions of future warfare. These problems will then be evaluated to determine how the current GRS system, and/or GRS policy, must be altered to meet future requirements.

b. The study will evaluate the graves registration service which will be required at various levels of conflict ranging from small police actions to major nuclear wars. In each instance, the current system will be applied to the level of conflict and only those changes which are necessary to meet estimated requirements will be recommended.

QMGPO-C

14 August 1961

SUBJECT: Combat Development Study Directive: "Graves Registration Operations Under Concepts of Future Warfare, QMCCD 56-9"

c. The study will give special consideration to the following:

- (1) Initial search and recovery procedures. An investigation will be made to determine if initial search and recovery by combat units will be feasible under future tactical concepts.
- (2) Handling and evacuation of bodies which are contaminated by a CBR agent. The study will investigate the possibilities of removal of bodies from contaminated areas as well as the practicality of burial of remains in a contaminated area by use of shielded or remote controlled equipment.
- (3) Identification. The study will investigate possibilities of providing a simple, positive means of identification when only the skeletal structure of an individual is recovered.
- (4) Concurrent return of remains program(s). The study will determine the feasibility of return of remains program during a conflict and at what level of conflict current return of remains program will be impractical.
- (5) Personal effects. The study will investigate possible means of reducing the volume of personal effects which must be disposed of.
- (6) New and improved equipment. The study will determine if any new or improved items of equipment will be required to support GRS operations of the future Army in the field.

d. The following areas, although related to GRS operations, are considered to be beyond the scope of this study and will not be considered in detail.

- (1) The application of ADPS to GRS operations. It is considered that this subject has been given adequate coverage in study referenced under paragraph 3c.
- (2) Return of remains programs which may be established following a major conflict.
- (3) Legal and financial implications of individuals carried as missing in action.

QMGPO-C

14 August 1961

SUBJECT: Combat Development Study Directive: "Graves Registration Operations Under Concepts of Future Warfare, QMCCD 56-9"

5. Administration.

a. Coordination: Draft studies will be coordinated with agencies as reflected in Inclosure Nr 1.

b. Suspense Dates.

(1) Draft to OQMG and CD agencies for coordination, 30 September 1961.

(2) Presentation of coordinated study to OQMG, 30 November 1961.

(3) Final coordinated study to USCONARC, 28 February 1962.

c. Distribution: Distribution of final studies will be made to those agencies listed in Inclosure Nr 1.

d. This project is assigned Project Nr QMCCD 56-9 and appears in paragraph 1620i of the Combat Development Objectives Guide.

FOR THE QUARTERMASTER GENERAL:

1 Incl
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/S/
/T/ R. T. EVANS, JR.
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INCLOSURE NR 1 to Study Directive

GRAVES REGISTRATION
OPERATIONS UNDER CONCEPTS OF FUTURE WARFARE

1. Purpose. To develop a concept of graves registration support for the future army in the field.

2. Scope. To develop policies and guidelines for organization, procedures, and material, with regard to recovery, identification evacuation, and burial of deceased troops under concepts of future warfare in the army in the field in the 1966-1971 period. The study will consider implications of mass casualties, effects of contamination, handling of personal effects, reporting procedures, and return program.

3. Combat Development Objectives (CDOG para 1410b)

"(4) Development and Maintenance of Morale. Many of the services such as the Army exchange, special service, welfare, troop information and food service may be severely restricted or eliminated on the future battlefield; however, individual performance of duty and contribution to unit effectiveness may be enhanced by improvement in methods and techniques in activities that directly affect morale and individual well-being. Continuing study is required to:

(d) Provide for graves registration procedures in mass casualty situations. Residual contamination, sanitation requirements, increase in the ratio of casualties to recovery personnel, and lack of transportation may require the use of mass burials. Unit dispersion may require the use of unit cemeteries and/or isolated burials."

4. Application.

a. The study is developed on the basis of the GRS support which will be required by a field army in future operations. It is primarily concerned with policies and concepts which are applicable from the forward area of the combat zone to the field army cemetery. Handling of remains in rear areas, in both conventional and CBR warfare, which may be received from hospitals or as the result of non-battle accidents, are not considered to be a major problem. Current procedures are applicable and have proven to be satisfactory. In CBR warfare, where mass destruction weapons are likely to be used in the COMMZ as well as in the field army area, the technical considerations of annex B will apply equally to both areas. The COMMZ may have some special large-scale disaster type problems if large logistical complexes, ports, and cities are destroyed by nuclear weapons. In such cases, the additional GRS support required should be provided by the rear area damage control plan and the civil affairs channel.

b. A recent study prepared by the Office of The Quartermaster General (reference para 3c of study directive) develops an excellent

reporting system which can be implemented on a manual or ADPS basis. As the system proposed in referenced study is considered to be fully adequate, this study has not further considered the area of records and reports.

c. Return programs are considered only in connection with concurrent return of remains as an alternative to temporary burial within the theater of operations. Post-war return programs which may be established following a major conflict are not considered to be within the scope of this study.

d. Graves registration support by the Army in a theater of operations to the Air Force and Navy, allies, civilian populace, and enemy is established and described in current publications. This study has determined no requirement for change in these regulations and procedures in providing GRS support in future warfare.

e. CBR warfare is defined by AR 220-58 as the offensive or defensive employment of chemical or biological agents or radioactive materials (including the radiological effects of atomic warfare) to facilitate the accomplishment of a specific mission. For convenience, where the term CBR is used in this study, it will also include the thermal and blast effects of nuclear weapons.

f. The terms "mass grave" and "trench grave", where used in this report, employ the definitions given in FM 10-63, Handling of Deceased Personnel in Theaters of Operations, DA, July 1959. In substance, a mass grave is defined as a row that is 3½ feet deep and of any length. It may be excavated with mechanical excavating equipment. The bodies are laid in it shoulder to shoulder without any intervening spaces or earth separations. It is generally used in the vicinity of the battlefield where mass deaths have occurred. The trench grave is a row in a cemetery plot at a temporary army cemetery. It may be excavated with mechanical excavating equipment to a depth of 2½ feet. However, individual graves are then dug in it one foot deeper with a distance of 2 feet between graves.

5. Research Methods. In developing the concepts proposed in this study, a variety of research methods and procedures was employed. This included study and evaluation of historical reports, after action reports, future strategic and tactical concepts, effects of mass destruction weapons, and various technical publications. In addition frequent conferences and interviews were held with representatives of interested agencies, including personnel of the Office of The Quartermaster General, HQ USCONARC, Army Medical Service, Chemical Corps, and Chaplains Branch. A research technique which had a major influence on the development of this study was the employment of a questionnaire. This questionnaire is developed by the Quartermaster Board and was filled out by more than two hundred senior, combat experienced, arms officers. These officers were selected on the basis of their extensive combat experience during World War II and/or the Korean conflict and represent the "user" viewpoint in GRS support.

6. Discussion.

a. General. The study takes into consideration that future warfare may be conventional, employing tactics and weapons similar to those used in past conflicts, or it may be nonconventional involving the use of mass-destruction weapons. As graves registration support required under these two conditions will vary greatly, they are considered in detail in separate annexes of this study. GRS support of conventional warfare is discussed in annex A and GRS support for nonconventional warfare is discussed in annex B. Annex C of the study considers new and/or improved GRS equipment which will be required in future operations. Annex D treats personal effects, while annex E presents an advanced concept of GRS support that is somewhat beyond the projected state of technological development anticipated in the next ten years.

b. Initial Search and Recovery.

(1) Initial search of the battlefield for the dead and recovery of remains is the first step in graves registration operations. Procedures to be followed in this phase of GRS will be dictated by the type of warfare being fought. In future conventional warfare, search, recovery, identification, and evacuation of remains to a collecting point will normally be done by tactical troop units. In warfare involving the use of mass destruction weapons, however, tactical requirements and safety of the unit will in most instances prevent troop units from recovering and evacuating their dead. Under these conditions, recovery and evacuation must be accomplished by GRS support units. In either case, recovery of remains should be accomplished as soon as the tactical situation will permit and recovery personnel will not be unduly exposed to danger in carrying out their task. A long standing policy, which should be continued, is never to endanger the living in recovery of the dead. A consideration of these factors leads to the obvious conclusion that remains may be recovered almost immediately (conventional warfare) or recovery may be delayed up to several months if the area is dangerously contaminated by fallout from nuclear weapons.

(2) Assuming mass casualty weapons are not being employed (and the threat of employment is not great), the company sustaining the loss will normally search for, recover, and identify remains as soon as feasible. Quick recovery by members of the same unit is important because of the greater probability of immediate identification as well as morale and esprit considerations. The company commander, however, must not let recovery action interfere with the accomplishment of his tactical mission or unduly endanger his unit. This is a decision which can only be made by the company commander at the time. If his unit is in a static position or movement is limited, he will have little difficulty in recovering his dead. On the other hand, if his unit is engaged in the exploitation phase of the battle, and he must continue the emphasis of the attack, he normally will have little or no opportunity for search and recovery action.

(3) If, in conventional warfare, recovery of remains cannot be done by the unit sustaining the loss, the task must be assumed by the next higher command echelon, normally the battalion. The company commander will report his losses to battalion along with known location of remains, and the service element of the battalion will recover and evacuate as soon as the tactical situation will permit this action.

(4) In warfare involving the use of mass casualty weapons, remains will normally be recovered by GRS support units as tactical units will have moved from the battle area before recovery is possible. There appears to be no practical solution to the problem of recovery of remains from a contaminated area except to wait until the area is safe for recovery personnel to enter. The possibility of using remote controlled or shielded equipment was investigated and discarded as being impractical. Even if the anticipated great cost and logistical support factors are disregarded, it is doubtful that a device can be developed in the next ten years which will be capable of doing the job. Remains will be in tanks and armored personnel carriers, under rubble, in bunkers, and other inaccessible places where the soldier sought cover. The practicality of any machine capable of searching for and recovering remains under these conditions is highly questionable. Another concept which is often mentioned is recovery of remains from a contaminated area by the use of helicopters and grappling hooks. The same factors which defeat the use of remote controlled recovery machines are applicable to the use of helicopters. Remains are usually difficult to locate even by recovery personnel searching the area on foot. Because of this difficulty in location, a hovering helicopter would be successful in recovering only a very small percentage of remains in a given area. Further, from a standpoint of cold realism, it is doubtful that recovery of remains will ever have a high enough priority to divert helicopter from tactical or supply missions to this type of work.

(5) The length of time required before recovery personnel can safely enter a contaminated area will vary greatly depending upon the type of weapon employed, terrain, climatic conditions and many other factors. In general, an area which has been attacked by a chemical agent in nonpersistent form can usually be entered almost immediately if normal precautionary measures are taken. This is not true of an area contaminated as the result of a nuclear strike as this area may remain highly radioactive for a period of from several days to several weeks or longer. Once the area has been determined to be safe for recovery personnel to enter, however, remains and personal effects will generally be safe to handle. This may not be true in all instances as it is possible for remains to contain fragments of metal or other material which still constitute a dangerous radiation hazard. While remains in this category are expected to be rare, recovery personnel should monitor all contaminated remains with appropriate instruments to determine the radiation count. This area is treated in detail in annex B of this study.

(6) In both conventional and CBR warfare, location of remains would be greatly facilitated if all troops were equipped with an individual signal emitter which would automatically go into action when the soldier became a casualty. Such a device would also be of great assistance to Army Medical Service personnel in locating wounded. It has been established as a requirement in the Army Medical Service Problems Guide, 1961 Edition, and several prototypes have been field tested at CDEC. However, such a device will complicate the already serious problem of saturation of communications bands and may also have security connotations. Therefore, development of such a device should, of necessity, be a joint project of the Medical, Signal, and Quartermaster Services and the Army Security Agency.

c. Identification.

(1) Identification of remains is perhaps the most important function of graves registration operations. Not only is identification essential because of legal implications and monetary cost to the government but it is in keeping with our way of life and basic philosophy that the individual is the most important element of our society. Even after death the importance of the individual is not diminished and the establishment of identity of remains is our way of manifesting this philosophy. Certain foreign governments do not plan to attempt individual identification of remains and will dispose of their dead in common graves keeping a record only of the number buried. This method may be satisfactory to a society which is not based on the importance of the individual but it will never be acceptable to the American people.

(2) The legal implications of cases where individuals are carried as missing in action for considerable periods of time are very involved. It is true that the Secretary of the Army may find an individual who has been missing for a period of one year to be dead as far as the army and Federal Government are concerned. It has been determined during the development of this study, however, that this finding is not binding on the courts of the individual states. Normally state courts require that an individual be missing for seven years before a finding of death is made. During this period estates cannot be settled, civilian insurance is not paid, and the wife of the person missing cannot, of course, remarry. From a financial standpoint the cost to the government of persons missing in action was considerable during past wars and it may well be staggering in future conflicts. All pay and allowances continue as long as a person is in a missing status.

(3) Identification has not been a problem to unit commanders in past conflicts if the remains are recovered immediately by members of the same unit sustaining the loss. Experienced combat commanders reported that identification of their own dead, when recovered in a reasonable time, was a problem only in exceptional cases. It follows then that every effort

should be made by personnel of a unit to recover and identify the bodies of their comrades who fell in battle. Unfortunately this is not always possible, as discussed earlier in this report, because of tactical considerations or the denial of an area by nuclear agents or persistent chemical agents. Under these conditions it may be impossible to recover remains for several days or, in some instances, even several months. In the meantime, the unit sustaining the loss has moved on and personal recognition statements are not possible; personal effects have disappeared, and it is no longer possible to obtain fingerprints when the remains are recovered. Now the long, laborious process of establishing identity begins. In past conflicts a remarkable record has been achieved in establishing positive identity of temporary unknowns. The process however, requires highly skilled technicians, rather extensive facilities and a great deal of time. It is doubtful that in any conflict involving the use of mass casualty weapons, resulting in a large number of unknown dead, the processing of unknowns as presently done could be continued.

(4) There is an urgent requirement for a simple, quick, positive means of identification of remains upon recovery, whether they be flesh covered or only skeletal. Two possible solutions to the problem, if technically feasible, would be to place permanent identifying symbols or serial numbers on 1) a major body bone(s); and 2) the buccal surfaces of one or more posterior teeth. The procedure would have to be simple, relatively painless, leave no external mark on the body, and take no longer to administer than it now takes to fingerprint. In conjunction with both of these methods, it would also be necessary to develop some sort of simple, lightweight, portable, device that could read the number instantly, even through flesh, and automatically record it. Under these concepts, all remains could be positively identified immediately upon locating or recovery regardless of how long this was done after time of death. Research projects should be initiated simultaneously on both of these projects to provide "more than one string to our bow".

(5) The large majority of experienced combat commanders who were questioned regarding the bone marking procedure, as discussed above, were highly in favor of the concept and believed service personnel as well as the general public would accept such a means of identification. There was a small number, however, who were of the opinion that such a procedure would have an adverse effect on troop morale, that it might be considered to be an invasion of personal rights or that it might be objected to on religious grounds. In consideration of these possible objections, it has been determined that there is no major religious group which would object to such a procedure on religious grounds so long as there is no external marking of the body. Regarding possible adverse effect on troop morale and invasion of personal rights, it is

not considered that the proposed procedure would have any greater impact on morale than the requirement that identification tags be worn at all times, or is any more of an invasion of personal rights than fingerprinting. While no opinion is available on the acceptability of the tooth marking procedure, it is likely that this would meet with less objection. If individuals felt strongly enough about it, once out of the military service they could have the marked tooth removed. However, the possible greater acceptability of the tooth marking procedure is offset to some extent by advice from experienced GRS personnel that skulls appear much more susceptible to damage than certain major body bones, such as the thigh bones. This may result in less identifications with the tooth marking method.

(6) As an interim measure, pending the development of a bone marking procedure, conventional identification measures as set forth in FM 10-63, Handling of Deceased Personnel in Theaters of Operation, should be continued, improved, and perfected. In all instances when remains are recovered with fingerprints intact, the hands should be sprayed with a plastic solution which will preserve the fingerprint impression indefinitely. Such a solution is presently under development and type classification of the material should be expedited. Another means of improving conventional identification methods would be to emboss or chemically etch the individual's name and service number on the buckle of his trouser belt where a belt is worn. Experienced GRS operating personnel report that the belt is usually found with the remains even when identification tags and personal effects are missing. If the regular issue belt is made from some rot-resistant material, and the individual's name and service number is stamped or etched on the buckle in a permanent manner, it will materially increase the probability of early identification even if recovery of the remains is delayed for a considerable period of time. As an alternate method, and in case the trouser belt should be discontinued as an item of the uniform (the trouser belt is not a component of present cold-weather clothing) consideration might be given to imbedding permanent metal identification discs or tags in the heels of the soldiers' shoes including direct molded-sole boots and insulated footwear. Here again experience shows that shoes are usually found with the body and last for a long time, particularly the shoe heels. Another measure that would help in identification would be a durable, long-lasting wallet or container to be issued to each man in which to keep his identification documents. This would be particularly useful in cases where nuclear fallout contaminated an area and prevented recovery of remains for several months. Such a wallet or container would safeguard identification papers from weather and deterioration.

d. Evacuation of Remains.

(1) Evacuation, as it pertains to graves registration operations, is the movement of remains from point of recovery to the army rear area where disposition takes place. If remains are recovered by tactical units, which is normally the case in conventional warfare, they will also be evacuated to the nearest forward collecting point by combat troops, but not necessarily of the same unit making the recovery. If recovery is delayed, because of contamination of the area or other factors, remains will normally be recovered and evacuated by GRS personnel in the post-battle phase of GRS operations.

(2) There has been some speculation that future warfare involving great unit dispersion may require the use of unit cemeteries and/or isolated burials. This concept is contrary to the belief of almost all experienced combat commanders who expressed an opinion on the subject. Isolated burials or burials in temporary unit cemeteries are considered only as a last resort solution to the problem. They are time consuming, difficult to accomplish under most conditions, and have a very bad effect on troop morale. As long as tactical units must depend upon rear areas for logistical support, there appears to be no valid reason why evacuation of remains cannot be done by returning supply vehicles except where mass casualties preclude evacuation.

(3) Assuming that the company commander has recovered his dead, he must next determine whether his unit is capable of evacuating the remains to the nearest collecting point which will normally be located in the battalion service area. This decision will be based on such considerations as the tactical mission of the unit, distance to the collecting point, transportation available, and other factors. Evacuation will be done by the company where feasible but the decision is the company commander's. If he determines that evacuation to a collecting point is beyond his capability, he will identify the remains, where possible, move them to the axis of advance, and notify his next command echelon of his action. When the company is actively engaged with the enemy this will probably be the normal procedure.

(4) The service company of the battalion will, under most conditions, evacuate the remains to the forward collecting point in the brigade trains area. Tactical battalions proposed for future divisional organizations are organized with a HQ and Service Company to provide administrative support to the units of the battalion. Supply vehicles of this organization will deliver supplies to the company from a distribution point established in the brigade trains area. Evacuation of remains to the collecting point established in the brigade trains area can be accomplished in these same supply vehicles. In past conflicts specific vehicles were designated for GRS operations because they became contaminated by body fluids and odors and were unusable for any

other purpose. This uneconomical use of transportation can be avoided if remains are properly shrouded prior to evacuation so that the evacuating vehicle will not become contaminated. There is a requirement for a lightweight, self-sealing, plastic (or other suitable material) sheet which can be used to seal the remains and prevent the escape of any fluid or odor during evacuation. (See annex C).

(5) Evacuation of remains from forward collecting points in the brigade trains area to the army cemetery is the responsibility of the army GRS organization. Supply vehicles, both land and air, which are returning after delivery of supplies should be utilized for this purpose. Again, a self-sealing, disposable sheet is required to wrap and seal the remains to prevent contamination of the evacuating vehicles. Evacuation will normally be made direct to the army cemetery, by-passing intermediate collecting points, whenever rearward-bound, line-haul supply vehicles are available.

(6) The employment of mass casualty weapons and the resulting increased number of remains may over-burden the evacuation system to the extent that evacuation will not be possible. If mass casualties are sustained, the sheer volume of remains and military necessity may make it necessary to employ mechanical earth moving equipment and "bury on the spot". While this procedure is not desirable, it may at times be the only solution. Little or no attempt at identification could be made unless a quick and simple identification method, as previously discussed in this report, is available.

(7) If the unit commander is unable to evacuate remains, and whether he is able to move them to the axis of advance or not, he should make every effort that the tactical situation will permit to identify remains and report the location of them to the next higher echelon. This is one of the most important aspects of graves registration operations.

e. Disposition of Remains.

(1) After recovery, identification and evacuation to a rear area, remains are normally disposed of by evacuation from the theater of operations or temporary burial in an army cemetery. There is also a third possibility which is permanent disposal of the remains within the theater. These methods of disposal are treated in detail in the annexes of this study and are discussed only briefly in the following paragraphs.

(2) Immediate evacuation of remains from a theater of operation is, in general, the most desirable method of disposition and is the procedure which is followed during peacetime. In the event of hostilities this practice should be followed as long as it is practical and continues to be in the best interest of the war effort. Some considerations which may make it necessary to discontinue a current return program include non-availability of appropriate transportation, refrigeration, steel for caskets, and trained personnel. Another consideration is the impact that a large volume of returning remains may have on the general public. If this becomes an adverse morale factor it may be necessary to discontinue the current return program. In any event continuation of a current return program will only be possible in small brush-fire wars or police actions. In large scale operations the volume of remains will undoubtedly be such that temporary disposition within the theater is essential.

(3) Temporary disposition of remains within the theater will normally be done by burial in army cemeteries. At times it may be necessary to establish division cemeteries but this practice, as well as hasty or isolated burial, should be avoided if possible. With the exception of mass casualty situations, evacuation of remains from a forward collecting point to an army cemetery should not be an insurmountable problem so long as logistical support is furnished from rear areas. It follows that establishment of division cemeteries will not normally be required. Three army cemeteries will usually be established in the army rear area which will provide a cemetery for each corps slice of the field army.

(4) Disposition of remains which have been contaminated by chemical, biological or nuclear agents will, in general, be by burial in army cemeteries in the same manner as uncontaminated remains. This is possible because by the time a body can be safely recovered from a contaminated area, the amount and intensity of contamination will be so small that the body is no longer dangerous to handle. There may be some exceptions to this generalization, and monitoring of all remains which have been exposed to contamination is essential. Remains which cannot be decontaminated because of the type of agent employed (anthrax) or because of radioactive fragments imbedded in the body, may require special processing and disposition (see annex B). If POW labor should be used at the army cemeteries in GRS burial operations, the use should be tempered by Article 52 of the Geneva Convention Relative to the Treatment of Prisoners of War, 27 July 1929, which prohibits use of POW's on dangerous labor unless it be voluntary. Although it is not considered that any danger will generally be involved at the army cemetery level in handling remains of personnel who had been contaminated previously by CBR agents, the exceptional cases noted above may be so construed in some quarters.

(5) If mass casualties are sustained, the number of remains may be so great that normal recovery, evacuation, and disposition will be impossible. Several thousand troops killed by a single, or series of, nuclear strikes within a division area in a short time would probably be entirely beyond the capability of practical conventional GRS support. Under such conditions, military necessity becomes the important issue and disposal of remains must be made in the most expedient manner. The most practical solution appears to be to bury in temporary mass graves using mechanical earth moving equipment. Such equipment support should be obtained from the Engineers on an as-needed basis. Since the requirement is not expected to be continuous, it would be inefficient and undesirable to make this equipment organic to the GRS units. Also, with regard to mass burials, current doctrine requires theater level approval for each mass burial. Since such burials will probably occur with moderate frequency in CBR warfare, it will become necessary to decentralize approval authority to lower levels. Doctrine should be changed to place this authority with division commanders.

(6) Permanent disposition of remains in the theater by means of cremation was investigated and rejected as a general policy. This method of disposal is not approved of by several major religious groups and is generally not acceptable to the American public. Quite aside from these considerations, the logistical support required by a policy of cremation would be greater than that required to dispose of remains by burial. Also, cremating nuclear contaminated bodies would not destroy the radio-activity -- it would merely dissipate it into the atmosphere to settle back to earth again as fallout. There will probably be isolated instances, however, where disposal by cremation may be essential to the health and welfare of the army in the field, such as with anthrax infestation. Under such circumstances command authority should authorize disposal by this means in specific cases.

f. Personal Effects.

(1) Recovery and evacuation of personal effects has been an annoying problem to unit commanders in past conflicts but few experienced combat commanders reported that it was a major problem or suggested that the practice be discontinued. It is proposed that our policy of returning personal effects to next of kin be continued during future conventional warfare and that in the event of CBR warfare, only essential changes to present policy be made. However, the amount of personal items which a soldier is permitted to take to a theater, or acquire while there, should be strictly controlled by command authority. In this connection, the military departments should determine what constitutes permissible personal effects which an individual may have in his possession in a theater of operations. After this list of items has been developed, army regulations should prescribe that an effort will be made to recover and return only those items which are on the authorized list.

(2) As stated previously in this report, personal effects recovered from a contaminated area will normally be safe to handle when it is safe for recovery personnel to enter the area. However, rings, watches and other metal objects may have been made radioactive by induced radiation and may not be safe to wear next to the skin for extended periods. Such articles may have a radiation count which will not be high enough to be dangerous to recovery handlers, but a local burn might develop if they are worn by the next of kin soon after recovery. To provide for this possibility, it is proposed that all personal effects which have been exposed to radiation be monitored at the effects depot in the theater prior to return to next of kin to determine the radiation count if any. If the article is free of contamination, or if contaminated and it can be safely decontaminated, it will be returned to the next of kin. If satisfactory decontamination cannot be achieved, or if the item is radioactive (due to neutron irradiation), it should be retained at the depot for about 90 days. This period will, with few exceptions, cause the contamination or radioactivity to decay to a safe level and enable return of the item to next of kin at the end of that time. Exceptional items which show evidence of very long radioactivity due to presence of long half-life elements, or which may have unfissioned nuclear fragments imbedded in them, should be disposed of permanently in the theater in accordance with radiological safety requirements and the next of kin so notified. The key to safe handling of personal effects which have been exposed to radiation is monitoring at each step in the evacuation chain.

g. Organization and Training.

(1) Organization for graves registration support of conventional warfare, as developed in two world wars and the Korean conflict is basically sound and workable. Almost without exception, experienced combat commanders reported that they considered the system good and suggested only minor changes in procedures. In general, they believe that some basic training in recovery and identification procedures and handling of personal effects is necessary for all combat troops and should be given during the unit training period. Extensive training in this subject, however, is not necessary or desirable for the combat soldier.

(2) Employment of mass destruction chemical, biological, or nuclear weapons will have an impact on GRS training requirements of both the combat soldier and GRS specialist. Emphasis on proper handling of remains and personal effects which may be contaminated and on protective and decontamination measures is essential. An indoctrination program also is necessary to explain the necessity for deferring recovery of remains from a contaminated area. Protective clothing for CBR contamination will generally be found adequate with the ordinary field uniform that provides full body coverage, rubber or canvas gloves, gas mask or respirator, and possibly cloth or plastic "booties" to be worn over the shoes. The gloves and mask

of respirator will be dependent on the type of contaminant encountered. Decontamination and protective measures are adequately covered in current appropriate military publications. (TM's 3-215, 3-216, 3-225 and FM 10-63). An additional new requirement for the GRS specialist is an ability to utilize CBR monitoring equipment and recognize levels of contamination which are hazardous. Such monitoring devices are a requirement at all levels of GRS operations.

(3) As discussed in detail in annex B of this report, induced and fallout radiation resulting from a nuclear strike may contaminate an area for a considerable period of time. After radiation in the area has decayed to a dose rate of about 3 rads per hour, it may be possible to enter the area for a limited time for emergency recovery purposes if considered essential. At this rate of exposure, however, it is not feasible for recovery personnel to work in the area on a continuing basis. If a dose rate of 30 rads per day is received, moderate disability will result after 10 days and continual exposure at this rate will result in a high percentage of death. A total accumulated dose of as little as 150 rads will probably result in significant late effects. A residual dose rate of 500 millirads per hour ($\frac{1}{2}$ rad) would be a comparatively safer level for GRS personnel to enter and work in a fallout area. However, it must be realized that any ionizing radiation is harmful and should be incurred only when absolutely necessary. Based on these considerations, it will be necessary to relieve GRS personnel assigned to search and recovery operations whenever their accumulated radiation dose reaches the limit which has been established as acceptable by the field army commander. The accumulated radiation dose of personnel working at the field army cemetery will, in all probability, be less than that of recovery personnel. An exchange of individuals so assigned will be desirable. This will require a more comprehensive training of GRS specialists so that they can function at any level of operations. As a standing policy, however, no personnel, including GRS personnel, should be exposed to any hazardous radiation in order to recover remains, unless it is considered essential by competent authority for tactical, sanitary, morale, or other weighty purpose.

(4) Since the end of the Korean conflict, there has been considerable change and reorganization of all types of army divisions. In regard to GRS support, the present organizational concept is to authorize the division a GRS platoon on an augmentation basis rather than as an organic element of the division. This is considered to be a false economy of manpower and can only result in confusion and unsatisfactory GRS support in the event of hostilities. It is assumed that the division will be augmented by a GRS platoon when hostilities begin, but this is not realistic as all elements of the division should work and train together to form an efficient team long before they are committed to an active theater. It is as important for the GRS unit of the division to

be an organic part of the organization as any other combat or logistical support element of the division. Only in this way can assurance be given that the necessary trained GRS units will be available to the division during the early stages of a conflict when they are so desperately needed. Authorization of an organic GRS platoon to all divisions would require only a comparative handful of men but would return big dividends in the event of a shooting war.

(5) No change in organizational structure for graves registration operations at the direct support and general support echelon is proposed. In the event of a conflict involving mass casualty weapons, the personnel authorization at each level of operations will probably have to be increased, but this will not effect the command and control organization. The nature of the increased support that will be required in CBR warfare (lacking development of advanced equipment and methods as noted in annex E) is not expected to differ from current GRS support. It will simply be more of the same. The workload will be much greater but the nature of it, aside from some requirement for decontamination and mass burial techniques, remains pretty much the same as at present. It is likely that the identification processing will be considerably reduced because of mass burials which will preclude identification under present methods. Personal effects volume will also be substantially reduced in these cases. While mass burials will reduce the evacuation workload, it will be more than offset by increased volume for GRS units because of hit-and-run tactics and because of the greater number of hospital deaths due to delayed thermal and radiation effects of nuclear weapons. The overall burial workload will be increased. However, while mass burials on the battlefield will relieve some of this workload at the army cemeteries, it will be offset at the cemeteries to some degree by an increased receipt of bodies from hospitals for the reasons noted above. In general, also, there will be a higher proportion of deaths behind the divisions in CBR warfare than there has been in conventional warfare. The use of mechanical equipment at the cemetery (as recommended in annex C) will reduce the requirement for labor but not for regular GRS personnel.

(6) All in all, the Board's best estimate of the increased support requirement is on the order of twofold to threefold. It must be noted that this is a bald judgment and cannot be supported with factual data since there simply is no CBR experience to go by. Such CBR casualty factors as have been developed are based on specific model situations and they vary widely in their results. They are not considered by themselves as a reliable basis but are useful, along with judgment and other factors, in arriving at the estimate noted above.

h. Equipment.

(1) Equipment required by GRS operations in future conflicts will be similar to that used in World War II and the Korean conflict with a few important additions. No attempt has been made in this study to justify standard equipment presently authorized GRS units. The following paragraphs pertain only to new or improved items which will be required. A more detailed consideration of these items is presented in annex C of this report.

(2) There is an urgent requirement for a lightweight, self-sealing, disposable wrap to be used to shroud and seal remains during the period of evacuation. The wrap should be made of a single sheet of plastic, or other suitable material; be opaque, moistureproof, puncture resistant, and capable of forming an air-tight package when wrapped about a remains. As discussed previously in this report, the purpose of this item is to prevent body fluids and odors from contaminating supply vehicles which are used to evacuate remains.

(3) There is a requirement at field army cemeteries for a mechanical earth moving device which can be attached to organic GRS vehicles and which is capable of digging a trench two feet wide and a minimum of 2½ feet deep in moderately soft ground. The device should be lightweight, require minimum maintenance, and be powered by TOE vehicles presently authorized QM GRS units. Commercial devices of this type, known as back hoes, are readily available in quantity "off-the-shelf" and have been well proven by extensive use. There is no need to develop a new military item for this purpose. In the past, graves were usually dug by hand which requires a considerable labor force as well as a great deal of time. Both of these may be at a premium in future warfare particularly CBR warfare. The proposed device would compensate for these factors and greatly increase efficiency at the cemetery. Heavy engineer equipment will not be suitable for this purpose because of cost, maintenance, and logistical support considerations.

(4) There is a requirement for a device to facilitate movement of remains from point of recovery to evacuating vehicles and within collecting points and the army cemetery. At present, this task is done by means of a litter which often requires four men to carry. QMR 1439d(18) CDOG, "Lightweight Rollagon-Type Litter Carrier", appears to meet this requirement and when developed, the item should be authorized GRS units at all levels.

(5) There is a requirement for an individual signal emitter to aid in locating wounded and dead personnel. The development of this item should be done in conjunction with the Army Medical Service which also has a requirement for this item. Also, coordination should be effected with the Signal Corps and Army Security Agency.

1. Casualty Rates.

(1) Conventional weapons. Casualty rates which can be expected in warfare fought with conventional weapons are available in FM 101-10. These rates are based on experience in World War II and the Korean conflict and are the basis of personnel authorization for current QM GRS units. Improved conventional weapons which are developed during the next ten years will probably have a higher kill rate than those used in past conflicts but this capability is compensated for by improved tactics such as wide dispersion and high mobility. Actual experience data pertaining to the kill rate of these new weapons is, of course, not available but the overall killed-in-action rate for future conventional warfare is not expected to increase by any large percentage, even if improved weapons are employed. Thus, GRS requirements to support future conventional warfare should not be materially different from past conflicts.

(2) Mass casualty weapons. Although a good deal of work has been done on estimating casualties when chemical, biological and nuclear weapons are employed, there is no good overall estimate of killed-in-action rates except for specific models or situations. Generally higher overall casualty rates can be expected in this type of warfare but how much higher is problematical. The casualty rate for nuclear weapons given in Part III of FM 101-10 is the best that is available but it must be recognized that it is only an estimate. There appears to be little doubt that the employment of mass casualty weapons will require more personnel in GRS support units. Until experience has determined what the workload will be, however, augmentation of present TOE units, as required, will be the best solution to the problem.

7. Conclusions.

a. The current graves registration system of the United States Army is basically sound and effective and is adequate to support future conventional warfare. Minor changes in procedures and improved equipment will increase the efficiency of the system.

b. For CBR warfare, the present basic GRS organization is suitable if the units are equipped with appropriate CBR detection and measuring devices, and the personnel are properly trained in aspects of contamination and mass burial techniques. However, substantially increased over-all GRS support will be necessary.

c. Identification of remains is a difficult problem in GRS operations unless identity is established immediately following death. An improved means of identification is desirable to reduce the time and skill now required. It is imperative in handling mass casualties.

d. Under CBR warfare, significant changes in GRS policy and procedures will be required:

(1) Because of the tactical conditions and contamination involved, combat units generally will be unable to recover, identify, and evacuate their dead. It will have to be done by GRS units.

(2) Bodies will have to be left lying in contaminated areas up to several months, depending upon agent employed and intensity of contamination, until it becomes safe for recovery personnel to enter the area. This applies mainly to nuclear contamination (see annex B).

(3) Mass deaths can be expected to be a frequent occurrence. This will necessitate burial on the battlefield in mass graves.

e. When it becomes safe to enter an area contaminated with CBR agents, it will generally be safe to handle bodies, provided proper protective measures are observed.

f. Adequate protection is afforded GRS personnel in handling and processing CBR contaminated bodies by the regular field uniform, rubber gloves, and, under certain conditions, the gas mask or respirator.

g. In small brush-fire wars and police actions, disposition of remains will be made by immediate evacuation to CONUS. In larger conflicts, when immediate evacuation is no longer practical, remains will be buried in temporary field army cemeteries. The trench method of interment should be the normal means of burial. Where mass casualties result from the unrestricted use of mass casualty weapons, it will probably be necessary to dispose of remains in mass graves employing mechanical earth moving equipment.

h. In most cases bodies that were subject to CBR contamination can be buried in army cemeteries in the normal fashion.

i. Some personal effects, such as gold rings and other jewelry, may become irradiated in nuclear warfare and be a potential source of harm to next-of-kin if forwarded to them too soon.

j. No reliable estimate of overall CBR casualty rates can be made. It is considered that they will be substantially higher than those for conventional weapons.

k. The present concept of furnishing necessary GRS personnel to the division on an augmentation basis is unsound and should be discontinued. The GRS platoon should be an organic element of the division in the same status as any other essential logistical or combat support unit.

8. Recommendations. It is recommended that:

- a. The commanding officer of the lowest organizational troop element (company) be responsible for initial recovery, identification, and evacuation of remains to the extent permitted by tactical requirements of his mission.
- b. If recovery and/or evacuation is not done by the company, the next higher tactical element be charged with this responsibility to the degree that its tactical mission permits.
- c. Disposition of remains be made by:
 - (1) Continuation of the current return program as long as practical and in the best interest of the war effort.
 - (2) Temporary burial at a temporary army cemetery within the theater, as a general policy, when current return is discontinued.
- d. All troop units receive, as part of their unit training, instruction in search and recovery procedures and the importance of safeguarding personal effects.
- e. Training of all GRS specialists include instruction in operation of radiation and other CBR detection and measuring equipment and proper procedures in handling of contaminated remains and personal effects.
- f. GRS elements of current and future divisions be authorized as an organic unit of the division rather than on an augmentation basis.
- g. Provision be made for adequate GRS support for CBR warfare by organizing technically trained GRS teams to be held on a stand-by basis, perhaps in the Army Reserve, to be mobilized and augmented with local labor, civilian or military, to augment the regular GRS units in event of CBR warfare.
- h. Doctrine be established for provision of adequate Engineer assistance to GRS units to support mass burials.
- i. Personal effects continue to be returned to next of kin but that all items which have been exposed to CBR contamination be monitored and held until safe to return. Where peculiar contamination conditions preclude this, the item should be permanently disposed of in the theater per approved safety requirements.

j. Military policy recognize that mass deaths will tend to be a frequent and normal occurrence in CBR warfare and will force a requirement for mass burials on the battlefield with a minimum of conventional GRS procedure.

k. Research projects be established to develop a quick and positive means of identifying deceased personnel, particularly in mass death occurrences. Research should include, but not be limited to, a means of placing permanent identifying symbols on a major bone in the body or on the buccal surfaces of some posterior teeth. In conjunction with this, a light, simple, durable, hand X-ray (or similar type) reader and recorder should be developed to provide for instant reading and automatic recording of the symbol through clothing and flesh.

l. A research project be coordinated with the Army Medical Service, Signal Corps, and Army Security Agency for the development of an individual signal emitter to aid in locating wounded and dead personnel.

m. Until the bone or tooth marking method is developed, a variety of additional conventional-type methods be adopted in addition to existing practices to aid in identifying remains. This could include:

(1) Embossing or chemically etching the individual's name and serial number on his trouser belt when issued, where a belt is worn.

(2) Making the belt of a rot-resistant material.

(3) Imbedding identification tags in shoe heels.

(4) Providing each man with a durable wallet or other container in which to keep his identification documents.

n. A policy be established of using regular supply vehicles for evacuation of remains when the vehicles are on the return cycle, upon development of the shroud to seal remains as proposed and recommended in the study.

o. The military departments determine what constitutes permissible personal effects and publish a policy that only authorized items (whenever possible) will be recovered and returned to next of kin.

p. The following items of equipment be developed and furnished GRS units as required:

(1) A lightweight, disposable, wrap or sheet to shroud and seal remains during evacuation.

(2) A mechanical earth moving attachment for organic vehicles of GRS units, capable of digging a trench 2 feet wide and 2½ feet deep.

(3) A device to facilitate movement of remains from point of recovery to evacuation vehicles, and within the army cemetery, such as the Army Medical Service's proposed lightweight rollagon-type litter carrier.

q. Appropriate portable AW and CW detection and measuring equipment now available or under development be provided to GRS units for monitoring contaminated remains, personal effects, and GRS personnel.

ANNEX A

CONVENTIONAL WARFARE

SECTION I

GENERAL

1. From the beginning of history, it has been the custom of man to honor and care for the bodies of his comrades who fell on the field of battle. Many different procedures have been followed through the ages and as warfare has become more complicated so have the organizations and methods employed to care for the dead. There has been little change, however, in the purpose of the operation which has continued to be 1) recovery of the body, 2) identification, and 3) proper disposition of the body.

2. There is no doubt that man will continue to desire to care for his dead and there appears to be no reason why he will not be capable of doing so in future wars if they are fought with conventional weapons. If mass destruction weapons are employed, the situation may be such that immediate recovery of the dead will be virtually impossible. The impact of CBR warfare on graves registration operations is discussed in annex B of this study.

3. Even if mass casualty weapons are not used, the threat of their use may require the employment of tactics which may make it more difficult to carry out GRS operations than in the past. The modification of present methods and procedures, as well as the introduction of new or improved items of equipment, may be required. These considerations will be discussed in the following sections of this annex.

SECTION II

INITIAL SEARCH AND RECOVERY

4. The initial search of the battlefield for the dead and the recovery of bodies, is the first step in graves registration procedures. This operation should be conducted as soon as the tactical situation will permit and is the responsibility of the commanding officer of the lowest organizational element. The assignment of this mission to the company commander may be questioned on the basis that it tends to interfere with his tactical mission. This, of course, he cannot permit to happen and, if it does, he has failed to properly evaluate the situation. During lulls in the fighting, however, or after the completion of local action, the company commander should and must take action to care for his wounded and dead. The necessity for this action is evident when two important factors are considered.

a. Prompt search of the battlefield and recovery of all apparent dead may result in the recovery of some seriously wounded who would die if not given immediate attention.

b. Prompt recovery of a body will, in almost all instances, result in positive identification. No one is in a better position to identify than the officers and men of an individual's own unit. Combat experienced commanders who were queried on this point indicated that difficulty in identification of men of their own unit developed only in exceptional cases.

5. The recovery of the body by a front line company does not appear to be a task which seriously interferes with the tactical mission of the unit. Location of the dead may, at times, be difficult but in most instances the men in a company know about where their comrades fell. A device which the Army Medical Service has proposed be built into the projected thermalibrium ensemble will also assist in locating bodies. This device consists of an electronic signal alarm which will send out a signal whenever a man is wounded. Obviously, the signal will sound if the man is killed and will facilitate location of the body. It is only when the company is required to evacuate the dead to a collecting point in the rear that the tactical mission of the unit may be jeopardized. This is particularly true during an attack or rapid movement of the unit. The company commander cannot further reduce the size of his already understrength command by detailing individuals to evacuate bodies to a collecting point and at the same time continue the emphasis of his attack. The most he can do is to recover the body, identify it, move it to a location on the axis of advance where it can be easily found, and notify his next command echelon of his action.

6. Future tactical concepts which prescribe great dispersion, high mobility, and independent operations of small units, will increase the difficulties of the company commander in the recovery of his dead. If his unit is employing "hit-and-run" tactics which demand that the company quickly disperse and move out of the battle area after an action, he will have little opportunity to search the area. In conventional warfare, however, tactics of this type will probably be the exception rather than the rule. This is especially true when operations are conducted in jungle or mountain terrain where mechanical mobility is limited. In future limited wars, or police actions, where mass casualty weapons are not employed, it appears that the company commander under most circumstances will have an opportunity to search for and recover his dead after a battle. He will, at the same time, have the capability of rapid dispersion of his unit after an action and, at times, he may be forced to employ such tactics. When this is true he will have no alternative but to defer recovery of the dead and will only report location of remains to higher headquarters. Recovery, identification and evacuation under these conditions will be done by the higher tactical command or GRS units on an area search basis.

7. A survey of opinion of 200 experienced combat commanders revealed that a considerable number believed it desirable to have special GRS units or teams recover the dead in all instances. There are several good arguments for such a procedure.

- a. It would permit the company commander to concentrate more fully on his tactical mission.
- b. It would relieve the combat soldier from an unpleasant task, of which he has too many.
- c. It would provide specially trained personnel to perform a specific task.

While the above considerations are worthy of careful evaluation, there are several arguments which can be advanced against the employment of GRS personnel in this manner.

- d. Population of the battlefield with additional support personnel will result.
- e. Remains would be recovered by individuals who are not permanent members of the unit sustaining the loss and identification would be more difficult.
- f. Providing GRS personnel in support of each company size unit would be prohibitive in manpower cost.

8. The final factor considered above, that is manpower cost, appears to be the overriding consideration and defeats the concept of providing GRS personnel to perform the initial search of the battlefield and recovery of remains. There will, of course, be instances when initial search and recovery operations cannot be accomplished by tactical troops and under these conditions GRS personnel will be employed. This will be the exception rather than the rule as the present policy of charging the unit commander with initial search for and recovery of his own dead is sound and should be continued. The psychological impact of the present policy on the esprit and morale of a unit should not be under-evaluated. A fighting unit can make no prouder statement than, "When we left the battlefield we carried our wounded and our dead with us."

9. In summary, it is proposed that in future conventional warfare, the company commander will, as in the past, be charged with the responsibility for the initial recovery and identification of his dead. While this should continue to be the policy and desirable practice, the company commander must be given the prerogative of determining when it is not feasible for him to accomplish this action. If his tactical mission or the safety of his command will be unduly jeopardized by attempting search and recovery procedures, then he must be relieved of this responsibility by his own determination.

SECTION III

EVACUATION OF REMAINS

10. Evacuation is the movement of remains from place of death through evacuation channels to a cemetery. The process usually involves passing the remains through one or more collecting points depending upon the distance involved between the place of recovery and the cemetery. As discussed in the previous section of this annex, remains may be recovered by tactical troops during or immediately following an engagement or they may be recovered as a result of the organized area search by GRS units in the post-combat phase of GRS operations. The objective in either case is the same, but the responsibility for the operation as well as procedures employed varies. The following paragraphs of this section will develop and discuss what is considered to be the most efficient method of operation in each case.

11. During the combat phase of GRS operations, recovery of the dead will normally be done by troops of the tactical company sustaining the loss. After recovery of the body and identification, if possible, the unit will either evacuate it to a collecting point or merely move the remains to a position on the axis of advance where it can be easily found and continue pursuit of its tactical objective. The action to be taken will be determined by the unit commander based on such considerations as the tactical situation, distance to the collecting point, availability of transportation, fatigue of his unit, number of bodies to be evacuated and other factors. It is considered that in future conflicts involving wide dispersion and high mobility, the ability of the company commander to evacuate his dead to a collecting point will be very limited.

12. The location of collecting points established in a division will depend upon deployment of the combat elements, dispersion, tactical plans, terrain, and other factors. As a general guide, at least one collecting point should normally be established in support of each command echelon immediately above the battalion. Assuming the battalions of the division are grouped into three tactical organizations (whether regiments, combat commands or brigades) there will usually be three collecting points in the division area. While there is no set frontage to which the tactical element subordinate to division (hereafter called brigade) is limited, it appears that control of a zone up to 10-15 kilometers in width and depth is reasonable. Under this assumption, a collecting point will be located about 5-10 kilometers from any point on the FEBA where most bodies will be recovered.

13. Evacuation of bodies to the collecting point, after recovery and movement to the axis of advance by the company sustaining the loss, will normally be done by service elements of the battalion. This is a proposed change to the policy which prescribes that the company, as the lowest

organizational element, will perform this function. It is not a change, however, to what has been normal operating procedures in past conflicts. Experienced combat commanders have indicated that almost without exception the evacuation of bodies was done by battalion or higher command echelon. This was particularly true during the attack or other rapid movement of the company. The company commander simply cannot carry out a GRS function and at the same time achieve his tactical objective. Nothing in this paragraph, however should be interpreted to mean that the company commander should not evacuate his dead to a collecting point when the situation will permit this action. Tactical battalions proposed for future operations are organized to provide administrative support to all elements of the battalion. As the HQ and Service Company of the battalion is provided vehicles to furnish unit distribution of supplies to companies of the battalion, there will be returning transportation available to evacuate the dead. A division distribution point will probably be established in support of each brigade where battalion supply vehicles will pick up supplies for their companies. Establishment of a collecting point at this same location will facilitate delivery of bodies being returned on battalion supply trucks. The establishment of a separate pool of vehicles and drivers to perform this function is a luxury we can ill afford. While the delivery of rations and the evacuation of bodies in the same vehicle is not a desirable operation, there is certainly nothing physically, morally, or religiously wrong in such a procedure. It is true that in past conflicts the vehicles used to evacuate bodies became contaminated and in some instances the odor became so strong that it eventually was necessary to destroy the vehicle. It appears that this could be avoided if bodies, prior to evacuation in vehicles, were wrapped in a lightweight, self-sealing, disposable, plastic or paper sheet which when sealed would prevent the escape of any body fluid or odor. (See annex C on equipment). Remains are frequently evacuated to the vicinity of the battalion aid station on litters. At this point they will be wrapped in the proposed shroud, prior to being loaded into battalion supply vehicles for further evacuation to the rear.

14. The collecting point established at the division distribution point in support of each brigade of the division is operated by QMC GRS personnel. Up to this point, evacuation of the body has been the responsibility of the tactical units of the division. From this collecting point to the army cemetery, evacuation is the responsibility of the Quartermaster Corps. The division collecting points (normally one in support of each brigade) are manned by QM personnel from the division support command.

15. After processing at the division collecting point, remains will be evacuated rearward under the direction of division GRS personnel and GRS personnel at the direct support echelon until they reach the temporary army cemetery. Desirably, remains should be evacuated directly from the division collecting points at brigade level straight to the army cemetery.

Determination of routing will depend upon transportation available and workload of the various collecting points. To the greatest extent possible, returning empty supply vehicles should be used for this work to avoid assignment of special full-time vehicles for the GRS evacuation operation. It must be recognized, however, that since many supply vehicles will operate only from one supply echelon to the next level, (e.g., from GS to DS point, or from DS point to division) they will be unable to make the entire trip from brigade collecting point to the army cemetery. This will necessitate transfer of the bodies from one carrier to another at the various supply echelons. The use of the wrapping sheet, recommended for development above, will facilitate this. However, in support of the concept of through shipment of supplies to the user from the farthest rearward point to the greatest extent practical, many supply vehicles will probably operate directly between GS point and division and between ADSEC depot and division. In such cases, these vehicles, when returning rearward to their base, could evacuate remains from brigade collecting point direct to the army cemetery. Evacuation by logistical aircraft used to deliver supplies to the division distribution point should be planned for and used to the extent practical and available, although it is recognized GRS operations will rate a low priority in this respect when compared to evacuation of wounded.

16. The discussion in above paragraphs pertains to evacuation during the combat phase of GRS operations. As indicated in Section II of this annex, however, there will be circumstances when combat troops cannot recover their own dead. Under these conditions, recovery as well as evacuation must be done by GRS personnel in the organized area search phase of GRS operations. The organized area search is conducted after hostilities have ceased in a specific area and the division has moved to another location. As division GRS personnel will move with the support command of the division, recovery and evacuation of bodies left in the area will be accomplished by GRS personnel of the direct support or general support elements of the field army. Collecting points will be established, as required, where remains will be processed and then evacuated direct to the army cemetery by designated army transport vehicles including aircraft when available. Remains recovered in this phase of the operation may be partially decomposed and should be wrapped in a self-sealing, plastic or paper, disposable sheet to prevent contamination of the evacuation vehicle and eliminate odors. A self-sealing sheet rather than a bag or pouch is more desirable for this purpose as the condition of the remains may make it difficult to use a bag or pouch.

SECTION IV

IDENTIFICATION

17. Prompt, positive identification of the dead is perhaps the most vital aspect of graves registration operations, and at the same time it is often the most difficult to accomplish. Identification is essential because of many considerations. In addition to the continued bereavement of the family when an individual is listed as missing in action for an extended period the legal implications become extremely involved. Insurance claims cannot be paid, estates cannot be settled, and the widow cannot remarry, to mention but a few considerations. Another factor which should be noted is the expense to the government which accrues when military dead are not promptly identified. The pay and allowances of an individual continue as long as he is carried as missing and this status may continue for years. If a large number of individuals are in a missing status the cost to the government may be staggering. Although the Secretary of the Army may, after review of all evidence, find an individual who has been missing for one year to be dead, this finding is not binding on the courts of the individual states. The results of a sample survey, which was made of the laws of 18 states, indicates that a finding of death by the military services under the Missing Persons Act is not acceptable as conclusive evidence of death in settling estates and other legal matters of the deceased.

18. In past conflicts it has been determined that the probability of identification of the dead lessens as time lapses after death due to deterioration of remains, (resulting in the loss of fingerprints or identifying scars) the evacuation or loss of other identifying media, and the fact that their own organization whose members are best able to make recognition has moved on. In view of this, it appears that the problem can be attacked on two fronts:

a. Emphasis on immediate recovery and identification at place and time of death.

b. The provision of some means of quickly and positively identifying even after deterioration of remains and loss of other identifying media.

19. As discussed in Section II of this annex, prompt recovery and identification of bodies by combat troops should be continued as in the past. When the tactical situation will permit completion of this task, the problem of identification is reduced to the point where it is virtually nonexistent. Even if the regulation identification tags are not found on the body (ID tags do not furnish positive identification but are strong supporting evidence) a personal recognition is usually possible by other members of the same unit. In the event the body is damaged to the extent

that recognition is not possible, identification can still be established through a combination of personal effects, location of the body, known losses to the unit and personal knowledge of other members of the unit who were present when the action took place. Of the more than 200 combat experienced commanders who replied to a question concerning identification, the large majority indicated that this was not a problem when members of their own unit were killed and recovery of the remains was made immediately because recognition is possible.

20. If recovery and identification of remains could be accomplished in all instances by combat troops immediately, there would be little problem in identification. It must be recognized, however, that there will be times when the tactical situation will not permit combat troops to recover their dead. Under these conditions search and recovery operations are conducted by teams of graves registration personnel in the post-combat phase of GRS activities and identification of bodies recovered is often an extremely difficult problem. It is true that in most instances recovered remains are eventually identified. It is also true, however, that identification of remains which are recovered after some considerable lapse of time is a laborious, time consuming task requiring trained technicians and special facilities. If regulation identification tags are found with the body, along with other personal effects, the problem of establishing identity is greatly reduced. Too often, however, these supporting items are not found, and other evidence must be discovered, evaluated and painstakingly compiled until there is no doubt as to identity.

21. A possible solution to the problem of identification, if technically feasible, would be to permanently mark a major bone in the body with some identifying symbol. The procedure would have to be simple, relatively painless, leave no external mark on the body and take no longer to administer than it now takes to fingerprint. Admittedly there is considerable doubt as to the feasibility of such a process and one authoritative source has advised that, at the present time, there is no known way to mark the skeleton of a man in this manner without surgery. Nevertheless, the concept has considerable merit and a feasibility study to determine if such a process is practical might well be warranted. An even more urgent need will be required for an identification method of this nature in the event of CBR warfare. Under CBR conditions, as discussed in detail in annex B, recovery of bodies will be difficult and delayed which will further complicate identification. The bone marking method of identification, if proven practical, was heartily indorsed by the majority of a group of wartime leaders in an opinion survey conducted in connection with this study. The big advantage of such a procedure would be that identification would be immediate and positive. If a bone in the body, such as the thigh bone (which is usually recovered even if some parts of the body are missing), is marked and then only this one bone is recovered the identity of the individual, as well as the fact that he is dead, can be positively established. Identification by this means would be equally effective when remains are recovered by combat troops

during an engagement. No attempt at identification would be required by the combat troops recovering the body. When the remains reached the division collecting point, the thigh bone symbol (perhaps ASN) would be read and identity established. It would, of course, be necessary to develop some sort of simple, lightweight, X-ray type reading device which would be capable of reading and automatically recording the symbol even though the skeleton was flesh covered. Such a device should be developed concurrently with the marking process. To determine the feasibility of the identification method discussed in this paragraph a QMDO covering the procedure should be established without delay. (See annex C)

22. Not all individuals surveyed on this question of identification agreed that marking of the skeleton, even if proven feasible, was a desirable solution to the problem. Some replies indicated that it would have an adverse effect on troop morale, that the public would not accept such a practice, that it was an invasion of personal rights and smacked of slave state concentration camp tactics, and that it might be objected to on religious grounds. On the other hand, it was generally agreed that identification of remains is essential and that every reasonable effort should be made to effect prompt identification.

23. Favorable impact on troop morale and general acceptance by the public are considered primarily to be questions of an adequate information and training program. Everyone agrees that identification of remains is essential and this is just a more efficient means of insuring that identification can be accomplished. It is no more an invasion of personal rights than the requirement that all service personnel be fingerprinted or be given shots. From a religious standpoint, information obtained indicated no major religious group would object to such a procedure so long as there is no external marking of the body.

24. One medical source suggested that while there was no known way to mark a bone in the body, primarily because there has never been a study of the problem, it is possible to make injections of certain elements into the flesh which will remain where injected indefinitely. If an element, such as bismuth (used as a medical injection for years), is injected in a pattern to form an identifying symbol, it could be read at any later date by means of X-ray. Such a system of identification would be useful, but it has definite limitations. If decomposition of the body has not taken place prior to recovery, fingerprints can be taken and identity established by that means. If decomposition has progressed to the point where only the skeleton remains, the injected symbol would, of course, be lost. Because of these considerations, pattern injection into a muscle of the body is not considered to be an acceptable substitute for a bone marking system of identification.

25. Another method proposed for permanently identifying remains involves marking permanent identifying symbols or serial numbers on the buccal surfaces of one or more posterior teeth. Current miniaturization techniques should make it technically feasible to place the required

amount of identifying information on the small surfaces involved. Perhaps the simplest method of making the markings would be to use a dye and imprint the identification on the tooth surface, if a suitable permanent dye is available or can be developed. Evidence shows that teeth normally remain in the jaw bone and do not decompose for many years after death. In this respect, they would provide a good basis for permanent identification. Current identification procedures employ dental recognition extensively in identifying skeletal remains and verifying identification in conjunction with other identifying media. However, this method is time-consuming and requires skilled personnel. The method proposed above would overcome these shortcomings. Generally, the tooth marking method may be easier and less costly to develop and be more acceptable than the bone marking method. However, it is susceptible to alteration through carelessness by possible subsequent dental filling work and extractions. Also, experienced GRS personnel advise that the skull is much more susceptible to damage and crushing on the battlefield than are the major body bones, such as thigh bones. These features may result in less identifications with the tooth marking method as compared with the bone marking method. Nevertheless, since the need is so urgent, both methods should be researched and developed simultaneously in the hope that one of them may become available soon. It would be well to carry both through to a successful conclusion in the event one of them does not prove entirely acceptable or satisfactory in use.

26. As the methods proposed above may not be at present technically feasible, it is essential that conventional means of identification be improved and perfected as an interim measure. One procedure which holds great promise is a system for preserving fingerprints by spraying the hands of the deceased with a plastic solution. The solution hardens in a very short time and retains the fingerprint impression in the plastic. Even after extended burial, the material, upon exhumation, provides a clear fingerprint impression. Continued research to perfect a system whereby fingerprint impressions could be retained indefinitely is highly desirable.

27. Application of the solution to the hands should normally be done at the army cemetery after fingerprints have been taken in the conventional manner. There may be times, however, when the condition of the body upon arrival at the collecting point is such that the fingerprints will be lost if the hands are not sprayed immediately. GRS personnel at the collecting point will make this determination and will spray the hands if the condition of the body indicates this is necessary. As SOP, the plastic solution should be applied prior to burial to the hands of all remains which are recovered with fingerprints intact.

28. While the above described system of preserving fingerprints will be very helpful in identifying the dead, in some instances, it will have little application unless the body is recovered and evacuated without delay. In delayed recovery where the fingerprints have deteriorated, the

best means of positive identification appears to be an identifying symbol on a major bone in the body or on the teeth as discussed in paragraphs 21-25 of this annex.

29. Nothing in this discussion of identification of remains should be interpreted to mean that present identifying procedures are ineffective or should be discontinued prior to the perfection of a new and improved procedure. Quite to the contrary, all current standard procedures employing such evidence as fingerprints, dental records, identification tags, and personal effects are highly effective when time and circumstances permit consideration and processing and should be continued.

SECTION V

DISPOSITION

30. Disposition of remains, after recovery, evacuation and identification, is the next step in graves registration operations. There are many possible means of accomplishing this task but they can be reduced to three categories.

- a. Immediate evacuation of the body from the theater of operations (known as concurrent return).
- b. Temporary burial in the theater.
- c. Disposition of the body in the theater by cremation or other means of permanent disposal.

These methods of disposition of remains will be discussed in the following paragraphs of this section. It should be noted that the subject under consideration is the immediate disposal of bodies within an active theater. Return programs which may be established after cessation of hostilities are beyond the scope of this study and are not considered.

31. Present policy is to immediately evacuate current dead from overseas theaters. This is a practice which is in keeping with our traditions and way of life and is generally favored by the public. In the event of hostilities, it is believed that this practice should be continued as long as possible. Small limited wars and local police actions will probably not result in more deaths than can be handled in this manner. After the body has been recovered and evacuated to the collecting point operated by the general support echelon in the army rear, a final check on identity is made and then it is evacuated from the combat zone. There are many factors which may limit this operation or make it infeasible, such as the number of bodies recovered, availability of refrigeration, availability of transportation, availability of trained personnel and adequate facilities, availability of steel for caskets and the distances involved. The advantages, however, are many:

- a. Bereavement of the family of the deceased is kept to a minimum as the body of their loved one is immediately returned to them.
- b. When this procedure was followed during the later stages of the Korean conflict, 100% identification was achieved.
- c. It eliminates the personnel, equipment, supplies and effort that would otherwise be required at temporary cemeteries.

d. There is no requirement for an expensive return program following the war.

32. Continuation of the current dead return program will depend to some extent upon the location of the combat zone with respect to its logistical support base. Bodies must be embalmed and prepared for return to next of kin and this can be most efficiently accomplished at a mortuary located outside the combat zone. During the Korean War, mortuaries were established in Japan for this purpose. The bodies were evacuated from Korea under refrigeration and were held in that state until prepared for return home by trained technicians in Japan. Plans to establish similar mortuaries to support areas where combat may take place in the future should be developed.

33. While continuation of the current dead return program in the event of hostilities is desirable, the sheer volume of dead in large-scale wars is likely to make this practice impracticable. In the event of a major conflict it will undoubtedly be necessary to dispose of bodies, either temporarily or permanently, within the theater of operations. Temporary disposition of remains can be accomplished by hasty burial or interment in an army cemetery.

34. Hasty burial as a means of temporary disposition of remains is recognized as necessary under certain conditions. During the campaign in the Solomons in World War II, the 25th Infantry Division was forced by a combination of inexperienced personnel, difficult terrain and a shortage of motor transport to practice hasty burial as a standard procedure. As a rule, however, this practice is resorted to by combat units only when evacuation is not possible. Of the 200 combat commanders questioned on this point only a small percentage approved of hasty burial when it is possible to evacuate. Comments pointed out that hasty burial has a very bad effect on troop morale and that usually there is no advantage in time as it takes as long to bury a body as it does to evacuate it, except under conditions encountered by the 25th Division. Even under conditions of wide dispersion and high mobility, combat commanders consider that hasty burial of their dead will be the exception rather than the rule. If a unit can be supported logistically from the rear, then it should be feasible for the logistical unit in support to evacuate the dead under most conditions.

35. Evacuation of bodies to the army cemetery, which is operated by the cemetery platoon of the QM general support battalion, is the most desirable practice if burial is to take place within the theater. There may be times when it will be necessary to establish cemeteries at division level, as was done in past conflicts, but this is not desirable and should be avoided if possible. The division must maintain its mobility which is hardly possible if it engages in cemetery operation.

36. Little change is anticipated in operations at army cemeteries from procedures presently prescribed. Because of the dispersion and wide frontage controlled by the field army, it probably will be necessary to operate one army cemetery in support of each corps slice. Current and proposed field army administrative support organizations provide for this capability.

37. At the army cemetery the workload will vary considerably depending upon the level of combat which is taking place at any particular time in the theater. Graves registration units can adjust to the increased workload during period of intense combat with the exception of being able to cope with the problem of opening and closing large numbers of individual graves. The conventional method of digging graves by hand is too slow an operation even if the large labor force required is available. There is a requirement for a lightweight earth moving device to be authorized as TOE equipment to GRS cemetery units. The device should be capable of digging a trench 2 feet wide and 2½ feet deep in moderately soft ground at a rate of about 3 feet per minute. It should require minimum maintenance, operate as an attachment to, and be powered by TOE vehicles which are presently authorized quartermaster GRS cemetery units. This device is commercially available "off-the-shelf" and does not require development of a new military item. Authorization of a large piece of engineer earth moving equipment to a GRS unit as a TOE item is not desirable because of cost and maintenance considerations. If authorization of a lightweight earth moving attachment is not considered to be feasible, then the commander of a GRS unit operating a cemetery should be authorized to call upon a local engineer unit for support when required. The Army Engineer should plan to make this equipment available as required and should designate the engineer unit at the general support level which will furnish the equipment and operator when requested.

38. In the past the last foot of earth at the bottom of a mechanically-excavated trench grave was dug by hand to form individual "pockets" for placement of the body. This was done so that bodies would not move and become intermingled when the grave was closed mechanically. The same result could be achieved if the bodies were placed in the trench grave without hand-digging the last foot of earth to form a pocket and then two stakes were driven on each side of the body to hold it in place during the back-fill operation. This procedure would be much faster and equally effective.

39. The third means of disposition to be considered is that of cremation or other permanent method of disposal of the body, perhaps by disintegration. This concept is often mentioned as a possible solution to the problem and may be technically practical in the very long range time period. At the present time, however, and quite aside from any morale or religious considerations, the logistical support of a policy of cremation on the battlefield would be greater than that required to maintain army cemeteries. Mobile crematories may be feasible but they

would add additional administrative petroleum consuming equipment to the field army, increase maintenance support required, and the characteristic stench would probably be devastating to troop morale. Crematories which are not mobile might be established in the army rear area in lieu of cemeteries but there seems to be little advantage in cremation at this location. Once the body is recovered, identified, and evacuated to the rear, it is simpler and requires less logistical support to bury it.

40. Permanent disposition of remains in the theater may become essential in the event of CBR warfare. This topic is treated more fully in annex B. For conventional warfare, however, cremation is not considered to be the solution to the problem. In addition to the greater logistical support required by such a practice, it is contrary to the beliefs of several major religious faiths and is generally not acceptable to the public at large. Only a small percentage of the combat commanders who expressed an opinion on the acceptability of cremation believed such a practice would be acceptable to the military forces of the United States or the general public.

41. In limited and conventional warfare, bodies should be immediately evacuated from the theater and returned to the CONUS as long as feasible. If the conflict expands to the point where concurrent return of the dead can no longer be accomplished, then temporary interment should be made in field army cemeteries.

SECTION VI

ORGANIZATION AND TRAINING

42. As indicated in previous sections of this annex, GRS support of future conventional warfare will not change materially from support furnished in past conflicts. It, therefore, follows that little change in organization to support future conventional warfare will be required. Organizations required to furnish GRS support in CBR warfare are discussed in annex B.

43. One important change in current organization at division level appears to be highly desirable. Present and proposed future divisional organizations authorize a GRS platoon on an augmentation basis rather than as an organic element of the division support command. This policy is based on the assumption that there is no requirement for a GRS capability in a division until hostilities occur. The danger in the policy is that when hostilities occur, it is too late to organize, train, and assign the required GRS unit to each division. It would be equally valid to assume that the division reconnaissance or artillery units should also be provided as an augmentation as they too will be required only in the event of hostilities. The simple fact is that the division is not a completely self-contained organization without all of its required components, including the GRS unit. It is as important for this element to be a part of the division during its period of organization and training as any other combat or support element. Only in this way can there be any assurance that a trained GRS unit will be available when required. The history of GRS support in two world wars and Korea clearly indicates the necessity for trained units during the early stages of the conflict. Without trained GRS units, many division commanders were forced to form provisional units made up of chaplains, medics, and badly needed infantrymen in an attempt to care for their dead. The results were in most instances less than satisfactory.

44. The number of personnel required to provide an organic GRS capability to all presently organized divisions is negligible. Divisions which are presently stationed overseas are augmented with a GRS platoon so no increase in personnel would be required. It is assumed that if additional divisions are activated, hostilities will have begun, or be imminent, and the GRS augmentation would be authorized. This leaves only the handful of GRS personnel required by the STRAC forces stationed in CONUS. Assignment of GRS personnel to STRAC forces is essential if these forces are to be truly capable of immediate deployment as a self-contained organization.

45. Training of personnel to perform GRS functions can be divided into two categories:

a. Technical training of specialist in identification procedures and cemetery operations.

b. General training of all troops in search and recovery procedures and the safe-guarding of personal effects.

46. Training of the specialist is the responsibility of the Quartermaster Corps and is conducted at the Quartermaster School. This training is adequate and has produced highly skilled GRS personnel. Training of other troops should be done during the unit training period. Extensive training in GRS procedures is not necessary or desirable, but training in basic search and recovery techniques and preservation of personal effects is essential. Too often in past conflicts soldiers have removed the personal effects from the bodies of their comrades in an honest and sincere desire to insure that they are returned to the next of kin. This not only reduces the probability of immediate identification, but there is also the possibility that the personal effects will be delivered to the deceased's home before official notification of death. The undesirable implications are obvious. As the combat soldier is responsible for the initial search, recovery, and identification actions in GRS operations, he should be given minimum adequate training in this area.

SECTION VII

RECOMMENDATIONS

It is recommended that:

47. As a general policy the commanding officer of the lowest organizational element continue to be responsible for the initial search for and recovery of the dead in his area of operations.

48. The commanding officer of the lowest organizational element be given the authority to make a determination as to the practicality of performing initial search and recovery and defer this action if he considers that it will jeopardize his tactical mission or unduly endanger his unit.

49. Remains be evacuated from point of recovery to the forward collecting point, established in the brigade service area, by tactical units. The company commander will evacuate to battalion if such action is within his capability, however, evacuation from company area to brigade collecting point will normally be done by the service element of the battalion.

50. Regular supply trucks (and aircraft to the extent available) be utilized in the evacuation of remains rather than establishing a pool of special vehicles for this purpose. (This recommendation is contingent upon approval and implementation of the recommendation which follows.)

51. A lightweight, self-sealing, disposable sheet be developed to be used to wrap and seal all remains prior to evacuation from point of recovery.

52. A lightweight earth moving attachment for organic vehicles be authorized as TOE equipment to Quartermaster GRS cemetery units.

53. The feasibility of providing a quick and positive means of identifying deceased personnel be determined. Research should include, but not be limited to, the possibility of placing a permanent identifying symbol on a major bone in the body and on buccal surfaces of posterior teeth as discussed in this study.

54. Type classification of the plastic spray to preserve fingerprints, which is presently under development, be expedited and the item be made available to GRS units as soon as possible. Further, when the plastic spray becomes available, the hands of all remains recovered with fingerprints intact be sprayed prior to temporary burial.

55. In the event of a small or "brush-fire" war, the present policy of immediate evacuation of current dead from an overseas theater be continued as long as feasible and in the best interest of national policy.

56. When a policy of immediate evacuation from the theater is no longer feasible, remains be interred in temporary army cemeteries established in the theater. Hasty and isolated burials will be avoided if possible.

57. Pending authorization of a lightweight earth moving device as TOE equipment to cemetery units, the GRS officer in charge of an army cemetery be authorized to call upon a designated engineer unit for assistance when it is necessary to open and close a large number of graves. The engineer unit to furnish the necessary mechanical equipment will be designated by the appropriate engineer commander.

58. When burial is made by the trench-burial method, the practice of digging by hand individual graves one foot deeper than the trench be discontinued and that in lieu thereof two stakes be driven on each side of the body to hold it in place during the closing of the grave.

59. GRS elements of current and future divisions be authorized as an organic unit of the division rather than on an augmentation basis.

60. All troops receive, as part of their unit training, instruction in search and recovery procedures and the importance of safeguarding of personal effects.

ANNEX B

CBR WARFARE

1. **General.** Annex A points out that, with certain moderate modifications and improvements, the present system of graves registration support is adequate for conventional type warfare. To the extent possible, in the interests of minimum types of organizations and simplification of training, a single basic graves registration support system is desirable for all types of warfare, but with the capability of being augmented to meet varying situations. In line with this policy, the purpose of this annex is to determine if the conventional system is adequate for CBR warfare. If not, what changes or augmentation may be required.

2. **Major Effects of CBR Warfare.** With relation to GRS support, the main differences between CBR and conventional warfare, or the principal new factors to be contended with, are 1) the contamination of bodies, personal effects, and areas; 2) the effect of the "hit-and-run" tactics that the use or threat of use of CBR weapons will produce, and 3) the large numbers of bodies resulting from frequent mass casualty situations. These factors will be examined below as they apply to the main areas of GRS support.

3. Hit-and-Run Warfare.

a. **Definition.** This type of warfare is expected to result from the use of CBR weapons. It may also be caused by the threat of use of CBR weapons. However, in view of the tactical problems involved in hit-and-run warfare, it is considered that the threat of use will have to be very firm. This type of warfare is defined as dispersion of forces in small units when not engaged, rapid assembly into larger units for engagements, and subsequent rapid disengagement and dispersion again into small hidden units. Under such conditions, it is doubtful that there will be a well-defined FEBA or a secured division rear area. It is more likely that the entire forward combat area to a depth of perhaps 25-50 kilometers will be fluid and constantly intermingled with friendly and enemy forces.

b. **Conventional GRS Methods and Hasty Burials.** The conventional GRS system of recovery, identification and evacuation by combat units cannot cope with this situation. Combat units will be hard pressed to handle their wounded, let alone their dead. If, after an action, they linger in position sufficiently long to gather their dead and either evacuate them or give them hasty burial, they invite destruction from nuclear weapons. The use of explosives, perhaps a small shaped charge, has been considered for expediting hasty burials under the above conditions. Even though this would speed up digging the grave, the time required to gather up personal effects and place them in the grave, perform initial identification, and cover the grave and mark it would be too much to be permitted

by the risk involved. If the area is contaminated by CBR, recovery will be delayed until it becomes safe to enter the area (see paragraphs 5 to 8). This would preclude the troop units from recovering their dead.

c. Recovery and Evacuation of Bodies by Troop Units. Of even greater significance than the risk factor will be the fact that, under hit-and-run tactics, combat units will move about a great deal and must always be ready to move instantly. This, it is believed will simply prohibit combat commanders from either lingering on the field to perform GRS operations or from leaving squads behind to do it. It will probably be quite safe for small squads to operate on the battlefield after the action has ceased -- they will be much too small a target to invite nuclear weapons. But their absence would prohibit their parent combat unit from being able to move rapidly with full complement as the situation may necessitate. Therefore, the conclusion emerges that combat units will generally not be able to recover and evacuate their dead under the hit-and-run tactics of CBR warfare.

d. Responsibilities of Quartermaster GRS Units. However, the dead cannot simply be abandoned permanently on the battlefield. It will be just as essential to recover, identify, and dispose of the dead in future warfare under CBR or any conditions as it now is. As was shown in annex A, this is essential for many cogent reasons: civilized regard for the dead, troop morale, public opinion, Geneva Convention requirements, cost of pay and allowances to the Army for missing-in-action cases (this ran as high as \$47,000,000 in Korea) and positive knowledge of death for surviving relatives for sentimental and psychological reasons, also for purposes of remarriage and settlement of estates. The answer to the problem may not be the most desirable but it is certainly simple and brooks little, if any, argument: If the combat elements cannot perform initial recovery, identification, and disposition and we do not dispute the fact that we cannot abandon our dead, then we must do the job with support personnel from the direct support echelon (DSU) at Army supply point level. Unquestionably, this will require an increase in GRS personnel at the DSU. Since it is anticipated that the combat elements will be unable to do this job as a rule rather than as an exception, it is not believed that the DSU can provide personnel for this GRS function from its other organic elements as a regular procedure. This would prevent these elements from performing their normal mission tasks. Therefore, the GRS capability at the DSU must be increased organically to handle this job. Since not all future warfare is expected to be of the CBR type and involve hit-and-run tactics, the strength increase should be an augmentation type to the conventional GRS platoon. This will provide flexibility and permit the same basic type of GRS platoon to function for virtually all types and scopes of warfare.

e. Relation to CBR Contamination. Some clarification of the above is necessary at this point with respect to the paragraphs that follow. It is pointed out in paragraphs 7 and 8 that nuclear residual contamination will prohibit entry into contaminated areas to recover bodies until several days to several months after explosion. This is

also true of CW contamination but to a much lesser degree, something on the order of a few days for persistent gases (but virtually no delay for nonpersistent gases). This might seem to imply that the discussion of hit-and-run is superfluous since ground contamination and delayed recovery of bodies will be the order of the day. This is not true. It is not expected that CBR warfare will involve 100% use of CBR agents nor that all battles, skirmishes, patrol actions, etc., will result in contamination. It is expected that a good deal of the actions will be conducted with or involve conventional type agents. In such cases, recovery of bodies could be done immediately theoretically. However, this is where the hit-and-run factor and the threat of CBR weapons comes into play. If units remain concentrated in an area long enough to present a suitable target, there is the probability of inviting a mass destruction strike. Therefore, it is considered that it will not be militarily feasible for troop units to attempt to recover their dead. This will apply not only to companies, but to battalions, and probably even to divisions. Therefore, under hit-and-run conditions where CBR agents and residual contamination are not involved, it is considered that the bulk of GRS support will have to be provided by GRS units at the DSU level or farther to the rear. As is pointed out in paragraph 8, where residual nuclear contamination occurs and a recovery delay of weeks is involved, the divisions and DSU's will probably have moved on and GRS operations will have to be conducted by GRS units from either the army service area or the COMMZ.

4. CBR Warfare - General. What kinds of wars will be fought in the next ten years? Will CBR weapons be employed? To what degree? The answers to these questions have a profound influence on the type of logistical support required. However, debate on these points is beyond the scope of this paper. What is presented herein is a proposed system for providing GRS support in case CBR warfare occurs. Any or all types of CBR agents may be employed in future wars. For GRS purposes, the concern is with the effects these weapons will have on bodies and their personal effects, and on the impact on recovery, identification, evacuation, and disposition.

5. Chemical Weapons.

a. Effects. The chemical weapons of interest are the lethal war gases; smoke and phosphorus and other non-lethal gases are not significant from a GRS standpoint. The war gases do not cause destruction or mutilation of bodies and will not aggravate the identification of bodies in this respect. They will contaminate bodies and areas residually to varying degrees depending on agent volatility and other factors. Generally this residual contaminant, i.e., the liquid form, will not be a significant deterrent to GRS operations as explained below. The majority of gases are nonpersistent and will not present a significant residual contamination hazard. For persistent gases, vapor

concentrations following a gas attack will be dangerous and recovery operations should be held in abeyance until the concentrations have deteriorated to a safe level, which may be on the order of a few days. The principal hazard in handling bodies is from contact with residual contaminant, that is, with clothing and equipment that has been splashed with liquid agent. The evidence developed during the study indicates that, under field conditions, the liquid form would usually consist only of tiny droplets of the aerosol type. Large splashes of liquid contaminant would be quite unusual and would be encountered infrequently. Therefore, generally in handling CW contaminated bodies, ordinary protective precautions and procedures will be adequate. This consists of combat boots, ordinary uniform, rubber gloves, and gas masks. Impermeable suits are not required. Gas masks, of course, are essential in these operations because of the inhalation hazard that will exist in the presence of residual CW contaminant.

b. Decontamination. The known CW agents deteriorate in the presence of sunlight and water. Chlorine compounds, such as supertropical bleach, are generally effective decontaminating agents. Burning or burial of clothing is completely effective, and laundering with established laundry formulas and procedures is also effective if reclamation is desired. Bodies can be disposed of by burial and will offer no hazard upon exhumation at a later date, especially in skeletal form. If processing of bodies is necessary, they become completely safe to handle when stripped of all clothing and bathed thoroughly to remove any possible surface contaminant on the skin. Once the CW agent is absorbed into the deceased's body and produces its reaction, it loses its toxicity.

6. Biological Weapons.

a. Effects. Biological agents, like CW agents, will not destroy or mutilate bodies and will not cause any special identification problems. Neither do they cause immediate death; they have incubation periods of several days, followed by sickness and, in many cases, death. Generally, personnel afflicted with disease could be expected to be evacuated to hospitals. If deaths resulted after this, the effect on GRS would be mitigated since recovery, evacuation, and identification would already have been done. However, BW attacks could be expected to result in epidemic conditions. This might result in deaths outside of hospitals due to overburdening of medical facilities and could involve GRS recovery, identification, and evacuation. The hazard in handling BW contaminated bodies would arise from inhalation of the BW agent. A properly fitted protective mask affords adequate protection against this. Contaminated areas could be safely entered immediately following an attack by observing prescribed precautions. This consists of the ordinary uniform which affords full body coverage, combat boots, cotton gloves, and an appropriate mask.

b. Decontamination. Chlorine, formalin, phenol, and/or hot to boiling water are effective BW decontaminating agents as described in current military literature and decontamination procedures. In GRS operations, the handlers who must enter the contaminated area or handle contaminated bodies can decontaminate themselves by having their clothing fumigated or laundered, mask disinfected, and by bathing themselves thoroughly after each exposure. For disposition of bodies, burial is effective with the possible exception of bodies infected by anthrax which may require burning. Burning or burial of clothing provides complete decontamination, although if reclamation is desired, laundering or fumigation will suffice.

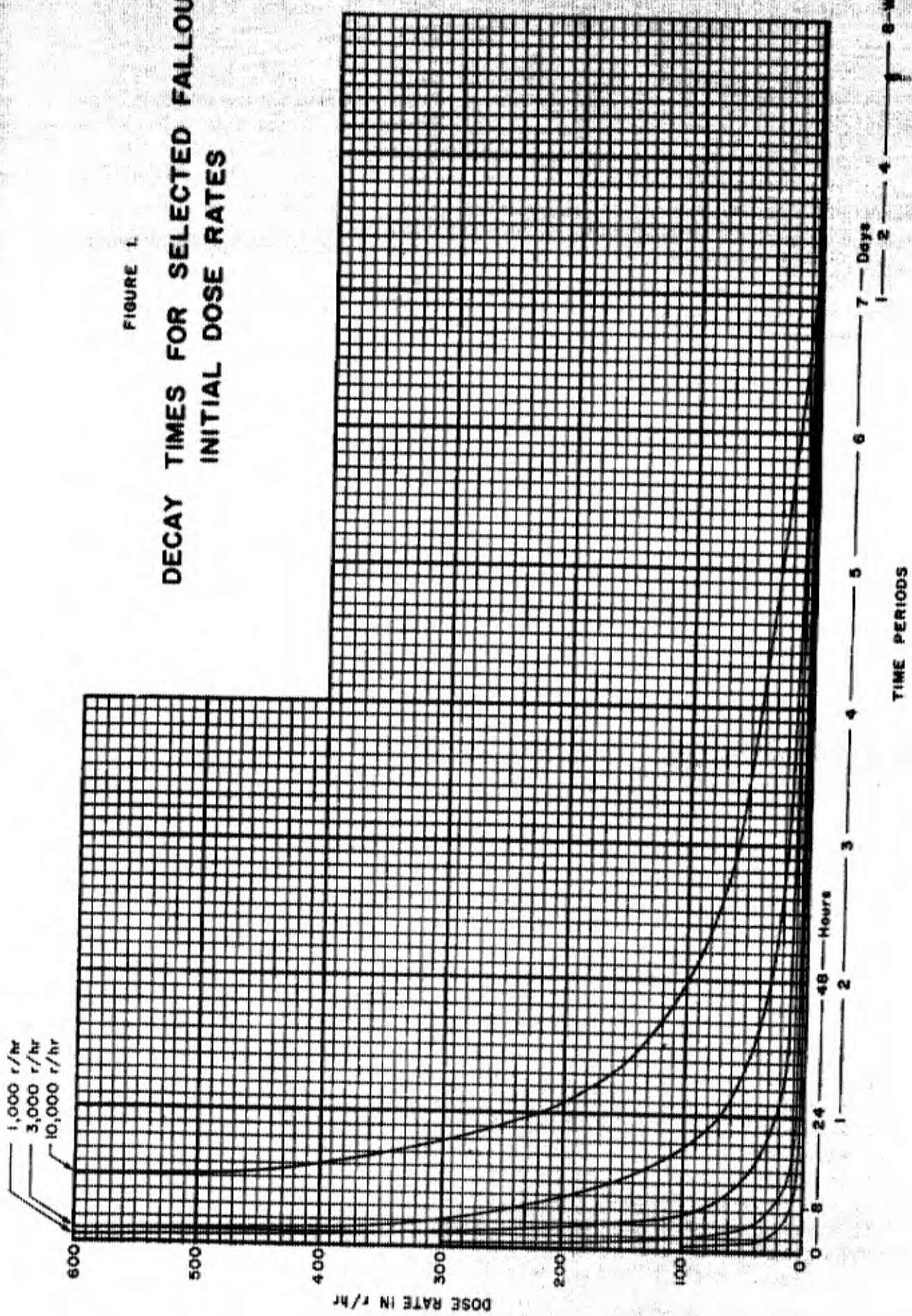
7. Nuclear Weapons.

a. General Effects. Nuclear weapons, unlike CW and BW, will cause considerable destruction and mutilation of bodies due to direct and secondary thermal and blast effects. Blast will cause bodies to be dismembered and smashed both by direct translation of the bodies themselves and by the secondary effects of other translated objects. Thermal effects will incinerate and sear bodies directly and many will be burned secondarily as a result of fires ignited by the thermal radiation. This will greatly aggravate the identification problem. In addition, residual radioactive contamination produced by nuclear weapons will be a serious complication in GRS operations. This occurs both in the case of fallout and as a result of induced radioactivity caused by the neutron flux of the exploding bomb.

b. Fallout. This is in essence a radioactive dust that is produced by surface and sub-surface bursts and also by low air bursts where the fireball touches the ground. It is much more prevalent with larger bombs than with small, sub-kiloton weapons. It settles to earth in the vicinity of the burst and can drift to some distance downwind. It is deposited on the surfaces of bodies, clothing, equipment, and areas. It does not irradiate objectives on which it settles, i.e., it does not cause them to become radioactive in themselves. Once the fallout is removed, the objects, such as bodies and clothing, become safe. Generally, fallout decays at a prescribed rate with approximately 99% of the radioactive intensity (dose rate) decaying in the first 48 hours but with the balance decaying over a much longer period in a logarithmic progression. (Figure 1). As a rough rule of thumb, fallout will decay tenfold for each sevenfold increase in the time after H + 1. This means that a fallout area that had a dose rate of 1000 rads/hour at H + 1 would have decayed to 10 rad/hr at H + 49, but it would take two weeks to get down to one rad. As a broad generalization, for the small atomic weapons that are visualized for the forward combat areas, it will probably not be safe to enter fallout areas to conduct GRS operations from one week to several months after the burst, depending on weapon yield and distance from ground zero (see paragraph 8a). The length of stay in such an area will depend on the Effective Accumulated Dose (EAD) of the recovery

FIGURE 1.

DECAY TIMES FOR SELECTED FALLOUT INITIAL DOSE RATES



personnel (see paragraph 7h). A number of successive bursts in the same area will cause a degree of build-up of the radiation dose and will compound the problem. Careful monitoring with survey instruments is the best means of determining the residual dose rate. If thermonuclear weapons or high yield atomic bombs are employed, as may occur in the COMMZ or in defensive or retrograde actions in the combat area, fallout may deny areas for long periods of time.

c. Recovery of Bodies from Fallout Areas. Evidence obtained during this study indicates that once a body is removed from the fallout area, it will probably have a low dose rate, perhaps on the order of one rad or less. Most of this will be on the clothing. If the clothing is stripped off, the remaining contamination will be insignificant and will constitute no appreciable hazard to handlers and laboratory processors. Contaminated clothing will be disposed of in accordance with directives pertaining to disposal of radioactive waste materials.

d. Induced Radiation. Exploding nuclear weapons emit neutron discharges in the vicinity of ground zero and exceeding the fireball radius. This neutron discharge or flux is relatively more intense in the smaller bombs, particularly in the sub-kiloton range. Unlike fallout, the neutron flux effect is manifested by induced radioactivity in certain chemical elements present in soil, bodies and some metals. This causes these objects to become radioactive internally. It is quite different from fallout in that it cannot be brushed or washed off the surface of the objects irradiated. Such radioactivity or irradiation must decay before the objects can be considered safe. The decay rate is directly related to the half-life of the particular chemical element that has been irradiated. As a broad generalization, irradiation will have subsided to a relatively safe level (outside of the immediate ground zero area) at the time that any fallout present has decayed to a safe level. To relate this more specifically to GRS considerations, it will generally be found that irradiation in bodies, tooth fillings, personal effects, and metal equipment has decayed to a relatively safe level when it is found safe to enter the area.

e. Irradiation of Bodies and Personal Effects. The neutron flux causes some degree of irradiation in bodies and personal effects. This is particularly true of blood sodium and of gold in tooth fillings, watches, and rings. To a lesser degree, it may be applicable to bone calcium, tin and copper in the silver amalgam of tooth fillings, and certain metal components of equipment such as identification tags and belt buckles. In all cases, however, the actual dose rate, particularly that which exists in these items when it becomes safe to recover the bodies, is so small as to constitute no appreciable hazard to handlers and processing personnel in the recovery, evacuation, laboratory identification and processing, or burial stages. In addition, the half-lives of the chemical elements that are irradiated in the above objects are short (sodium is about 15 hours and gold is 2.7 days for the isotopes concerned) and decay is relatively rapid.

f. Special Treatment of Gold Personal Effects. Despite the very small dose rate given off by an irradiated gold ring, wrist watch, jewelry, or similar gold personal effects, authoritative sources contacted during this study advised certain precautions with these objects. (It was estimated by one source that a ring or watch might have an initial dose rate from neutron irradiation on the order of a low number of micro curies, perhaps something like 100.) This applies to the matter of returning such items to next of kin while they may still be irradiated. It was considered that if such irradiated items were returned to next of kin while they were still radioactive, and such items as rings or watches were worn by the next of kin as mementoes, they might possibly receive local radiation burns over a period of time. If such an item were held in the theater effects depot for several months before returning it to next of kin, its dose rate and radioactivity would have decayed to a safe level. To be entirely safe and certain, a policy should be adopted of arbitrarily retaining personal effects, which have been exposed to radiation and which cannot be satisfactorily decontaminated, in the theater until three months have passed. Even then, personal effects that contain chemical elements that are susceptible to irradiation should be monitored with adequate survey instruments before being returned to next of kin. Occasionally, a case might occur where a personal effects object contains some very long half-life element that was irradiated. Or it might possibly contain fragments of irradiated material or unfissioned bomb material (see below). In these cases, monitoring would disclose such a condition and the item should be permanently disposed of in accordance with radiological safety regulations. In storing irradiated personal effects in theater effects depots temporarily, precautions will have to be taken to avoid creating a radiological hazard to operating personnel. Despite the fact that the very small dose rate given off by an individual ring or watch is not hazardous to operating personnel, when many of these objects are piled up together, as in a storage bin, an appreciable dose rate could be generated that may prove hazardous to operating personnel. Thus, it may be necessary to place such items in shielded containers (see Table 4) while awaiting their decay to safe radiological levels before returning them to next of kin. Or perhaps it may only be necessary to distribute them throughout the depot in small enough lots so that no hazard is created. Monitoring with survey instruments will provide a check on this problem.

g. Bomb Fragments and Unfissioned Material. The possibility of irradiated or radioactive fragments from nuclear bombs or destroyed equipment becoming imbedded in bodies was considered. Information obtained indicated generally that all bomb components and casing would be vaporized in the explosion and resulting fireball. It is possible that malfunctions of the bombs will occur occasionally and this might produce irradiated bomb fragments and perhaps bits of unfissioned radioactive material. It is also possible that, with high-neutron-flux

sub-kiloton bombs, equipment (guns, tanks, trucks, etc.) outside the fireball radius might be irradiated by the neutron flux and also be blown to pieces by the blast effect. This could produce irradiated fragments (manganese in steel is susceptible to irradiation) which might become imbedded in bodies. In this latter case where the irradiated fragments come from destroyed equipment, it is probable that the chemical elements affected would have short half-lives (manganese is 2.6 hours) and would offer no greater problem than that presented by irradiated blood sodium and gold in tooth fillings and jewelry. By the time it was safe to recover these bodies, the irradiated fragments they might contain would have subsided to a safe level. With unfissioned bits of bomb material, a serious problem may be presented. Some of these materials are highly radioactive and have extremely long half-lives on the order of tens to thousands of years. Proper monitoring with survey instruments would disclose whether bodies contained fragments of this nature. It is probable that a body containing such fragments would not have a very high dose rate. It could probably be handled and processed by GRS personnel with reasonable safety with proper radiological safety precautions, once it was safe enough to retrieve the body from the contaminated area. However, such bodies constitute a potential long-range hazard because of the long-life emitters they contain in the fragments. The risk involved lies in the possibility of the burial ground being disturbed at some later date, perhaps many years in the future when the body had decomposed and the hazardous emitters thereby becoming exposed. Since it would be reasonably safe for GRS personnel to handle such bodies after recovery as was noted above, the most practical way to process these bodies in the field would be to remove the high radioactive fragments by surgical debridement. Otherwise, it may be necessary to bury the body permanently in the theater in a case of concrete, lead, or other dense shielding material to prevent harm in case of future disinterment. This latter process may not be feasible at the army cemetery and the debridement method appears more practical. The radioactive fragments would have to be disposed of in accordance with approved radiological safety regulations, perhaps by encasing in adequate shielding and burial. Since the fragments are likely to be quite small and not in great quantity, burial in shielded containers appears to be practical. Perhaps small lead "bottles" might be provided for this emergency purpose.

h. Safety of GRS Personnel. Personnel who continually come into contact with radiologically contaminated areas, bodies and equipment will be exposed to hazards, even though the hazard from an individual body or object may be almost nil. In general, it is agreed that any nuclear radiation penetrating the bodies of human beings is undesirable. Radiation doses too small to have any observable effect on an exposed individual during his lifetime may still produce genetic effects which may appear in future generations. At somewhat higher doses, direct

effects on the individual can be expected such as a shortening of the life span. This shortening of the life span may result not only as the consequence of damage to specific tissues as seen in the development of skin cancer and leukemia, but also as a result of such general factors as lowered immunity, damage to connective tissue, and premature aging. If significant late effects are to be averted, a total accumulated dose greater than 150 rads cannot be accepted.¹ This limitation applies to the entire lifetime of an individual. Even stricter limitations are imposed for avoiding early effects, i.e., sickness which would prevent a man from performing his duty. For example, exposure limits for his purpose are 75r in one day, 100r in three days, and 125r in one week. Generally, no deaths are to be expected for exposures not exceeding 200 rads. Table 1 gives an estimate of the casualties that can be expected from radiation exposure and is applicable to GRS personnel. If the late effects are disregarded (and this will have to be a command decision), temporary rotation of GRS personnel can help to compensate to some degree for radiation exposure. The body can recover to some extent from the effects of non-acute relatively mild radiation doses received over a prolonged period. Some consider this type of radiation injury as approximately 90 and 10 per cent reparable and irraparable, respectively, with the former being accomplished in about three months, but nearly 50 per cent complete in one month.² The total radiation dose an individual has accumulated when corrected by biological repair described above, results in the Effective Accumulated Dose (EAD). This is the critical factor for the individual. It shows how much more, if any, radiation he may be exposed to without exceeding permissible limits or exposing him to adverse effects. The search and recovery platoons will probably be the most vulnerable with regard to radiation exposure. By the same token, it is reasonable to assume that the cemetery platoon is less likely to accumulate a significant dose. Therefore, these platoons could be rotated. However, this should be examined closely before being adopted as a policy to determine if the cross-training involved is worthwhile. It may be simpler to rotate the search and recovery personnel to some other type of work such as supply handling and, in turn, rotate the supply handling to GRS search and recovery work. Before rotating new personnel into the GRS search and recovery work, their EAD should be examined to insure that they do not have an accumulated dose of such degree as to prevent them from remaining in search and recovery for a reasonable time. However, personnel should not be exposed to hazardous radiation to recover bodies except for urgent military reasons (see para 8a).

1. TM 3-225, Radiological Recovery of Fixed Military Installations, DA, April 1958.

2. CEX-58.8, Comparative Nuclear Effects of Biomedical Interest, AEC, January 61, citing as a source the National Council on Radiation Protection Subcommittee 14 Handbook, Exposure to Radiation in an Emergency.

It may be well to emphasize at this point the urgent essentiality for maintaining continuous records of the cumulative radiation doses received by all GRS personnel in the theater. This, of course, applies equally to all other personnel in the theater. It is imperative that suitable instruments for this purpose be included in the GRS unit TOE's and other Quartermaster TOE's. In addition, provision must be made to include in these GRS TOE's appropriate radiac monitoring or survey instruments to determine dose rates in contaminated areas and from contaminated bodies, personal effects, and equipment as discussed earlier in this annex. Appropriate radiac instruments are standardized and available and improved ones are being developed.

Generally, no requirement is seen for any unusual type of protective clothing or equipment for GRS personnel in handling radiologically contaminated bodies and personal effects other than an approved respirator. Once a contaminated area is safe to enter, the required uniform may consist of ordinary field uniform that affords full body coverage, with the addition of rubber gloves and the respirator. Some competent authorities consider that wearing of the respirator should be a mandatory requirement when entering a nuclear contaminated area. Even though the area may be safe enough to conduct GRS recovery operations, it is likely that some low level of contamination will still exist. This contamination will be composed of the longer-lived nuclides, some of them having extremely long half-lives. As a source of external radiation, the emission rate may be low and they may present no hazard; however, if taken internally, such as by inhalation, they may present a serious long-range hazard. It may also be found advisable to wear some type of cloth or plastic cover over the boots which may be discarded or laundered after emerging from the contaminated area. In handling contaminated bodies, as was pointed out earlier, once the clothing is removed, the body itself is safe to handle. It will be necessary to wear a respirator in removing contaminated clothing to prevent inhalation of radioactive particles. Appropriate radiological safety information applicable to working in contaminated areas and handling contaminated objects is given in appendix C, TM 3-225 Radiological Recovery of Fixed Military Installations. Gloves will afford no protection against irradiated items; however, as was noted earlier, the dose rate from irradiated items generally will not be a hazard.

1. Safety Criteria. As a policy, personnel should not be exposed to any hazardous radiation to recover bodies except for emergencies and urgent military reasons, such as tactical requirements, sanitation, and morale as determined by competent military authority. Entry into radioactive areas to recover bodies in GRS operations should be guided by the data presented in Tables 1 and 3 and the additional comments made below. In isolated instances, personnel could conduct GRS operations in radioactive areas for emergency purposes and not suffer adverse early effects or significant late effects if the total dose received during their stay did not exceed 75r. However, if this were repeated several times, it is likely that adverse early and/or late effects would ensue as indicated in the referenced tables.

Table 1
CASUALTY RISK TABLE*
 Estimated Medical Effects of Radiation Doses Expressed as
 Probability of Sickness or Death

Measured Dose (r)	Early Effects for Periods of Time Over Which Total Dose is Received											
	1 Day		3 Days		1 Week		1 Month		3 Months or More		Significant Late Effect	
	Sick-ness	Death	Sick-ness	Death	Sick-ness	Death	Sick-ness	Death	Sick-ness	Death		
0 to 75	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	None
100	2	0	0	0	0	0	0	0	0	0	0	None
125	15	0	2	0	0	0	0	0	0	0	0	None
150	25	0	10	0	0	2	0	0	0	0	0	None
200	50	0	25	0	0	15	0	2	0	0	0	None
300	100	20	60	5	0	40	0	15	0	0	0	Some
450	100	50	100	25	15	90	15	50	0	5	0	Some
650	100	95	100	90	40	100	40	80	10	10	0	Some

NOTE: This table applies to healthy, young adults under usual working conditions. The probability of fatalities will be decreased with adequate medical treatment. The casualty estimates are based on an interpretation of the best current available evidence and may be changed as more information is accumulated.

*Taken from TM 3-225, Radiological Recovery of Fixed Military Installations, DA, April 1958.

Further, DA Pamphlet 39-3, The Effects of Nuclear Weapons, in commenting on genetic effects caused by radiation exposure, states in paragraph 11.131 that "there is apparently no amount of radiation, however small, that does not cause some increase in the normal mutation frequency. The dose rate of the radiation exposure or its duration have little influence; it is the total accumulated dose to the gonads that is the important quantity." Also, the Atomic Energy Commission in its publication CEX 58.8 (see footnote 2) cites the Genetics Committee of the National Academy of Sciences as recommending that the total cumulative dose to the reproductive organs be limited for individuals to 50r up to age 30 and an additional 50r up to age 40. Since the majority of troops are likely to be under age 30, this will be a critical factor. As a general operating procedure in conducting GRS operations, bodies should not be recovered until radioactive areas become entirely safe.

8. Recovery and Evacuation.

a. Entering and Working in Contaminated Areas. No serious problems are foreseen in this respect with BW and CW agents. Safe entry times and protective measures for these agents are discussed in paragraphs 5 and 6 above. Unless mass casualties develop, which is discussed separately below, it should be practical to handle small-scale BW and CW remains by regular GRS procedures, observing the precautions cited in paragraphs 5 and 6 above.

Residual nuclear contamination is a different matter. In order to avoid exposing search and recovery personnel to dangerous radiation, the only practical solution seems to be to wait until the contaminated areas become safe to enter. This can run from 3 days to 26 weeks and more depending on the dose rate in a given area and time after explosion. Even then, personnel will be able to stay in these areas for only limited periods, and this should be resorted to only under urgent, emergency conditions. As a general policy, personnel should not be exposed to any radiation hazards to recover bodies unless required by urgent military necessity. Normally, bodies should not be recovered until the area becomes entirely safe. Table 2 shows the estimated length of time it takes for certain fallout initial dose rates to decay to certain selected low levels for possible entry times.

Table 2

Decay Periods of Fallout Residual Activity for Certain Selected Entry Dose Rates

Dose Rate at H/1 (r/hr)	Selected Entry Dose Rate	
	3 r/hr	0.5 r/hr
	Time for Fallout to Decay to Selected Entry Dose Rate	
100	19 hrs	4 days
300	2 days	9.3 days
1,000	5.5 days	4 weeks
3,000	2 weeks	9 weeks
10,000	6 weeks	26 weeks

Where neutron-induced radiation occurs in the soil in conjunction with fallout, it will generally have decayed to safe levels when the fallout has done so. It has a much shorter contaminating "range" than fallout and will usually be centered relatively in the vicinity of ground zero and usually in the high fallout isodose curves. Neutron-induced radiation in soil (and bodies and equipment) can also occur from low air bursts of nuclear weapons where the fireball does not touch the ground. In such cases, no fallout would be present and the induced contamination would be the only problem. The amount of induced radiation in the soil is directly related to the type of soil and the proportions of chemical elements it contains. Soil having a high sodium content, commonly referred to as Type II, remains radioactive from induced radiation longer than most soils. In cases of neutron-induced radiation from these air bursts, safe entry time should be determined by monitoring and by evaluation of the type of soil present. Decay rates can then be computed by reference to pertinent nomographs in appropriate radiological effects manuals, (DA Pamphlet 39-1 and others).

Table 3 shows the injurious effects on man of certain selected doses received over varying periods of time.

Table 3

Some Estimated Doses for Varying Degrees of Injury to Man*

Dose Rate (r/day)	Period of Time	Effect
60	10 days	Morbidity and mortality high with crippling disabilities
50	15 days	50% deaths in 30 days
30	10 days	Disability moderate
10	365 days	Some deaths
3	Few Months	No drop in efficiency
0.5	Many Months	No large-scale drop in life span

*Based on material in Radiological Health Handbook. USPHS. Sep 60.

It can be seen from the above tables that if recovery personnel work three hours a day for thirty days in an area with a dose rate of only 3 r/hr, there will be a substantial amount of sickness and loss of efficiency. It should be noted at this point that background radiation would have to be taken into consideration. Frequent use of nuclear weapons in an area will almost certainly result in a build-up of the normal background radiation level. To what levels is unpredictable-- it will be influenced by the intensity of nuclear warfare and many other factors. It is obvious, though, that it would be pointless to await entry into an area based on a predetermined safe entry dose rate that was lower than the prevailing background dose rate.

Note that Table 3, with the exception of the last item, takes into account only the early or tactical effects of radiation exposure. Since all the men who had worked three hours a day for thirty days in a 3 r/hr dose rate area would have been exposed to a total dose in excess of 150r, they could suffer significant late effects. Such effects are manifested later in life by possible leukemia, shortening of the life span, and greater incidence of genetic mutations. There is no reasonable justification for deliberately exposing personnel to certain sickness or death and serious late effects in order to recover dead bodies, even though they be our own dead. In fact, military necessity prohibits such a policy, simply from a standpoint of the additional personnel replacements required and overburdening of medical facilities. Even though the policy of this country is and long has been to make every attempt to recover the dead as quickly as possible and quails from the

thought of leaving them lying on the battlefield for prolonged periods, nuclear warfare at present seems to offer no other feasible alternative. It is not considered that any great amount of education of the public will be necessary to accept this situation. Public opinion may countenance the risking of a soldier's life to recover a wounded buddy, but what wife or mother will support a policy of risking a husband or son to recover a dead body? Anyway, it will not be necessary to simply abandon the bodies and forget about recovery completely; it simply means that recovery must be delayed for several weeks or months. Then recovery can be effected with relative safety.

b. Unusual Recovery Methods. Consideration was given to various methods for possibly recovering remains without imperiling recovery personnel. One of these was remote-controlled equipment in the nature of an unmanned vehicle which could be guided into the contaminated area by a remote operator to locate bodies, pick them up, load them onto the vehicle, and bring them out. Such a vehicle would be guided by some type of radio waves and use television to enable the remote operator to see. The many practical problems involved make the feasibility of this method highly questionable. While the machine might be able to recover bodies out in the open fairly well, it is unlikely that it could locate and retrieve them from foxholes, under rubble, in wrecked equipment, in blowdown areas, etc. Also, it probably would not be usable in jungle and rough terrain.

The helicopter was also considered. It is possible for helicopters to recover bodies from the ground with a grapple attached to a hydraulic hoist. The ship must hover in order to grapple and the most effective and practical height for this is about ten feet. When hovering close to the ground, an air cushion is created which helps sustain the ship in the air. As the hovering height increases, there is less lift from the air cushion which requires a greater use of engine power. At heights in the 100-300 foot range, the use of engine power is close to maximum. This becomes ruinous to the engines and is impractical. Also, it becomes more difficult and time-consuming to grapple as the height increases. Battlefields, even in fairly open country, are frequently cluttered with wrecked equipment, buildings, and broken-off trees. This would impede the helicopter's operation and probably require it to hover at a greater height than ten feet, reducing its efficiency. Bodies that were under rubble, equipment, trees, in foxholes and buildings, or partially covered by earth would be unrecoverable by the grappling method.

The attenuation factor for residual gamma radiation at 20 feet above the ground is 2. Applying this factor to a 1,000 r/hr dose rate in a fallout area, the pilot would receive something on the order of 2 r/hr if he started to work in the area four days after the explosion. Two days after explosion, the dose rate would be about 5 r/hr. An accumulated dose of 300r in 30 days will produce 15% sickness; a total accumulated dose of 150r will produce significant late effects. This is

an unacceptable risk for the recovery of dead bodies. Therefore, to avoid hazard and injury to the pilots, it would be necessary to limit their working periods in the contaminated area. In mass casualty situations, the total time consumed working under these conditions is considered infeasible. Another factor is that if the bodies have decomposed to any extent, it becomes increasingly difficult if not impossible to grapple them. After four days in the tropics, most bodies would be beyond the point of grappling.

From a logistical standpoint, it is hardly conceivable that sufficient helicopters will ever be available, or even an appreciable number of them for this type of work. It is doubtful, from a standpoint of cold realism and military necessity, that recovery of dead bodies could ever have a high enough priority to divert scarce helicopters to this work. The number that would be required to handle a mass casualty situation, where the bodies could very well number several thousand, is out of the question. The POL consumption, always critical, is unsupportable, as would be maintenance and repair parts support. The use of helicopters to recover dead bodies from nuclear contaminated areas in mass casualty situations is operationally and logistically infeasible.

The use of manned shielded recovery vehicles employing manipulators for picking up and loading bodies onto the vehicle was also considered. The large logistical burden this would create is considered unsupportable when compared to the resulting advantage, that of recovering contaminated bodies a few weeks or so sooner than by waiting until the area cooled off sufficiently to permit safe entry for normal operating procedures to be employed.

c. Mass Casualties and Non-Mass Casualties. It is expected that both types of situations can and will occur in CBR warfare. Where target acquisition is good and troops are caught in the open in unprotected positions or are poorly trained and the CEP is small, mass casualties can be expected. The reverse of the above situations and conditions can result in considerably smaller numbers of casualties. Where the number of bodies is not great, it should be practical to recover bodies (when the area becomes safe to enter), and evacuate, identify, and bury them using fairly regular GRS procedures, but observing the proper protective precautions and measures outlined earlier in this annex. The succeeding paragraphs on recovery, evacuation, identification, and disposition deal with this latter situation where the number of bodies is not excessive and does not constitute what is commonly termed "mass casualties."

d. Responsibility for Recovery and Evacuation. It is unlikely that combat units will be able to perform these functions in nuclear warfare. Two things tend to preclude them: hit-and-run tactics and residual contamination of areas where nuclear strikes occur, which is likely to be an entire battlefield. While some bodies may be carried

out by surviving ambulatory troops when they are departing the area of a strike, this will probably constitute an insignificant percentage. To recover the other bodies, it will be necessary to wait until the area has cooled to a safe point. By this time the combat units with their support elements will undoubtedly have moved on and be engaged elsewhere. This leaves the job to be done by GRS search and recovery units, probably from Army service elements or perhaps from COMMZ support elements. This is something that must be recognized and accepted. The combat units will not be able to do this job in nuclear warfare. It will have to be done by rear support elements, and perhaps only to the degree that manpower and military necessity may permit.

In evacuating contaminated remains, care must be taken to prevent contamination of handlers, drivers, and vehicles. The wrapping sheet recommended in annex C will minimize contact contamination. Gas masks or respirators will prevent inhalation of hazardous vapors or material, depending on the agent. Gamma radiation from a truckload of radioactive contaminated bodies may present something of a hazard to the driver. Adequate shielding on the back of the truck cab would provide protection but it may be impractical. Some shielding materials and factors are shown in Table 4. A 4' x 4' shield of lead with an attenuation

Table 4

Approximate Attenuation Factors for Gamma Rays from Fission Products as a Function of Shield Thickness for Indicated Materials*

Attenuation Factor	Shield Thickness in Inches			
	Lead (710 lb/cu ft)	Steel (490 lb/cu ft)	Concrete (144 lb/cu ft)	Wood (Fir) (3.4 lb/cu ft)
2	0.28	0.7	2.5	9.2
10	1.0	2.7	9.7	36.
50	1.6	4.2	14.	55.
100	1.9	4.8	16.	62.

*Data from DA Pamphlet 39-3, The Effects of Nuclear Weapons.

factor of 100 placed on the back of a truck cab would weigh about 1,800 pounds and be about 2" thick. Other materials would be thicker and weigh more. However, experience with nuclear tests has indicated that much of the fallout on a body is blown and shaken off when it is handled and transported. Even so considering that the bodies would be sealed in a wrapping sheet when placed in the truck to avoid contaminating the truck

and the fact that there may be a dozen or more bodies in the vehicle, it is considered that an appreciable hazard could accrue to a driver who was engaged in this work for some time. A metal truck cab would afford some shielding, but it may not be enough. The loads should be monitored to determine if they are hazardous. If so, some shielding of the cab would be desirable, although this would tend to make a special-purpose vehicle of the truck. An alternate and simpler method would be to strip the clothing from the bodies before placing them on the truck and discard the clothing. An examination would have to be made of the clothing to discover and keep or record any identification data or items (until an improved identification method is developed). Personal effects that were returned with the bodies would probably not present a sufficient problem to be a hazard to the driver. If they were irradiated and had a sufficient dose to be of some concern, they could be placed at the rear of the truck under the bodies. This would provide sufficient shielding to minimize their possible hazard. Care would have to be taken to correlate the items with the pertinent bodies before separating them from the bodies for the above purpose. In transporting bodies that have been subjected to a nuclear contaminant, it would be best not to use ration supply vehicles. Even though the bodies are encased in the plastic wrapping sheet, it is improbable that contamination control will be sufficiently exacting under field operating conditions to prevent some contamination of the vehicles. If some of this contamination, which would probably be composed of long half-life nuclides, were to be transferred to ration packages, it is possible that they might subsequently be ingested by personnel and create a serious long-range hazard. Therefore, ration supply vehicles should not be used to transport nuclear contaminated remains. This problem would not be significant with other types of supply vehicles.

In recovering bodies from areas where nuclear explosions have occurred, the bodies, in many cases, may be buried beneath rubble, wrecked buildings and equipment, and perhaps in blowdowns (woods and forests leveled by blast forces). This situation is quite certain to exist where nuclear warfare is conducted in developed and sophisticated areas. In such cases, recovery units will require adequate equipment to be effective. This should consist of such equipment as cutting torches, jacks, digging tools, demolitions, and similar items. This equipment could be made up as special kits for GRS units and held available to be issued in case of nuclear warfare. In addition, standing doctrine and procedures should be developed to provide for adequate engineer support with cranes, bulldozers, etc. to assist recovery teams in this work. Perhaps special Engineer 3-500 teams might be designed for this support purpose.

e. Identification. As was pointed out in earlier sections of this annex, when bodies have been recovered and are treated with proper safety precautions, they can be safely processed for identification where necessary. Present identification methods can be employed. It would be more desirable to have an almost instantaneous, simple identification

method so as to preclude any possibility of hazard to handlers and processors. This is imperative where mass casualties are concerned as will be discussed below. Such a method is suggested and discussed in annex A of this study and in paragraph 9c below.

f. Disposition. Generally, when CBR weapons have been used, remains that have been recovered can be buried in the normal fashion. Bodies containing radioactive fragments would require special processing prior to disposition. This is discussed in paragraph 7g.

In the fluid and dispersed conditions that will prevail in CBR warfare, there will likely be a number of army cemeteries rather than only one. The number will tend to be governed by the size of the field army area and distance from collecting points. Division cemeteries may be necessary as conditions dictate. A specific pattern or policy laid down at this time for number and location of cemeteries under CBR warfare is not considered wise. Modern CBR warfare has not yet been fought and no experience data exists. In this particular matter, the situation must be met as it develops. Broad guidelines to apply might be to keep the number of cemeteries to a minimum to simplify post-war recovery of bodies. Since it seems that the bulk of recovery of bodies will have to be done by GRS support elements from Army service or COMMZ troops, there seems to be small likelihood of many division cemeteries. Once the above GRS units recover the bodies and wrap each in the wrapping mantle described in annex C, it would seem best to move them to the army cemeteries.

9. Mass Burial.

a. Definition. This is defined as a situation where hundreds and perhaps several thousand dead bodies result from use of mass casualty weapons. It is necessary to properly orient one's thinking when evaluating this matter. The nuclear battlefield will hardly be one where an isolated and occasional atomic weapon is exploded at infrequent intervals. Particularly with the advent of usable small yield and sub-kiloton weapons, it is more realistic to conceive the nuclear battlefield as one where atomic explosions are occurring with some frequency and in some quantity. Whether a war can last any length of time under these conditions is problematical and is beyond the ability of the authors of this document to forecast. Obviously, if wholesale use of nuclear weapons brought nuclear warfare to a close in a matter of weeks, the GRS problem would be greatly diminished. All recovery and related GRS activities could be suspended until after the termination of the active war, and recovering and processing of the dead could then be conducted in greater detail and with ample time. However, at this point, in the absence of previous experience with nuclear warfare, we must assume that it would be possible for nuclear warfare to continue at length. Under such conditions, it is quite likely that mass casualties would be a common occurrence rather than an isolated instance.

b. Incidence. Mass casualties, in themselves, are not new to modern warfare; they occurred in the previous wars within our lifetime. However, they were isolated instances in those wars and radioactive contamination was not involved. This is the critical and key feature of future CBR warfare, particularly nuclear warfare; mass casualties can be expected to occur as a normal thing and with some frequency. The biggest problem is not going to be the contamination of the areas involved. It is going to be the sheer volume of bodies resulting from mass casualty incidents plus the frequency of such incidents coupled with the added factor that all of this will probably occur in a relatively short time, i.e., probably over a matter of months rather than years, as in previous conventional wars.

c. Problems. It does not seem reasonable to believe that we will have or can afford the personnel, transportation, and time to recover all these bodies, evacuate them, process them for identification, and bury them individually. Identification itself will be a far greater problem than it has been in the past. It must be remembered that bodies cannot be recovered from radioactive areas until several weeks or more have elapsed and the area has become safe to enter and work in. This virtually eliminates recognition as a means of identification, and this has been a big assist in the past in this matter. Also, many bodies may be beyond the point of fingerprinting. Therefore, it is likely that the great majority of bodies would have to be laboratory-processed to obtain identification. This is time consuming and is considered almost impossible with frequent mass casualties. Identification, nevertheless, is considered essential as is explained in some detail in annex A. Therefore, a method must be developed that will provide positive identification very simply and quickly. Suggested concepts for such rapid identification are described in annex A and consists briefly of imprinting a code of some type, perhaps a man's serial number, on a major bone of his body or on the buccal surfaces of posterior teeth at the time of induction or POE processing. A way would have to be worked out to do this quickly, painlessly, and without surgery or harm to the man. It must also be done with some process that will enable it to be read and recorded quickly and easily by means of a hand-portable X-ray or similar type device if the man becomes a casualty. The mass casualty situation points up the urgent necessity for some method of this type. It is essential that it be developed.

d. Method. In view of the foregoing evaluation, the procedure for handling mass remains in nuclear warfare is as follows: After the contaminated areas become safe for entry and work, GRS teams, aided by such labor as could be mustered, would gather bodies and move them to a central point or several points on the battlefield. Identification would be read from the body and recorded with a hand device as described in the previous paragraph. Earth moving equipment would excavate large trenches in which the bodies would be laid without any separations. Again, because

of the volume of bodies, it is not considered possible to dig separate depressions in the mass trench for each body. The trench would then be covered over by the equipment. Depending on conditions, it may be found necessary or advisable to place several layers of bodies in one trench with a foot of earth in between layers. Marking of trenches and recording could be done as presently prescribed. As for personal effects, they would be left with each body and buried with it. If the mass casualty situations arise before the identification method proposed above can be developed, it is considered that the bodies will have to be interred as described herein without identification processing. This is very undesirable because of the great impact it will have morale-wise and legally on the surviving kin; also the monetary cost to the government if these men must be carried as missing in action. Therefore, again, the urgent necessity for a quick, positive identification method is stressed.

e. Authority. Current doctrine requires theater level approval for each mass burial. Since such burials will probably occur with moderate frequency in CBR warfare, it will become necessary to decentralize approval authority to lower levels. Doctrine should be changed to place this authority with division commanders.

f. Epilogue. The manner of dealing with military mass casualties proposed here is not a pleasant one. It may not be considered acceptable. Nevertheless, as was pointed out previously, nuclear warfare may require us to do many things we do not like to do but must do out of sheer necessity. This is considered one of them. Within the present state of technology and as far as can be foreseen for the next ten years, no better solution is seen.

10. Casualty Rates.

a. Conventional Weapons. Casualty rates for this type of warfare are available in FM 101-10, Organization, Technical, and Logistical Data. These rates are based on experience in World War II and Korea. GRS support for warfare fought with conventional weapons should be based on the prospective workload generated by these rates.

b. Improved Conventional Weapons. Improved conventional type weapons will become available during the next ten years which will have a higher rate and probability of kill than current ones. Whether this will affect casualty rates is problematical when all things are considered. Future sophisticated warfare will generally be more mobile than in the past. Infantry will operate in APC's much more so than in the past. Target acquisition will be more difficult. In unsophisticated warfare, such as jungle type, group targets will tend to be scarce and the emphasis will be on the smaller weapons. All of these contribute to some degree of compensation for the higher potential kill rate of the improved weapons. No experience data pertaining to these weapons is available nor will have any real validity until they have been tried in large-scale use. It is

estimated that the improved conventional weapons will cause some small increase in killed-in-action (KIA) rates. This should have little effect on GRS support requirements.

c. CBR Weapons. A good deal of work has been done on casualty rates for all three types of agents here. However, the best that can be done, short of the experience of warfare, is to predict kill rates for specific models or situations. A good deal of this has been done, but it is of little practical value in predicting overall casualty rates for GRS purposes. Authorities interviewed were unanimous in agreeing that no reliable overall casualty rates can be predicted for this area until large-scale use experience has been obtained. This means after they are used in warfare. It is generally agreed that their use will result in higher casualty rates than for conventional weapons. How much higher is problematical -- probably quite a bit higher. The rate for nuclear weapons given in Part III of FM 101-10 is the best that is available at present but must be recognized as only an estimate. There is little doubt that use of CBR agents will require substantially greater GRS support than has been provided in the past for conventional warfare.

11. Organization.

a. Type. Whether future warfare will be conventional or CBR is unpredictable. The ideal organization is a single type that is sufficiently flexible to meet a wide variety of conditions. This can be achieved reasonably well in providing adequate GRS support for future warfare. Basic GRS support for all types of future warfare foreseeable within the next ten years should be built around the present conventional GRS organization. It should be improved by the addition of the equipment recommended in this study, by adequate CBR and mass burial training as described below, and by the development of an improved identification method as described elsewhere in this report.

b. Amount. This is generally based on workload which, in turn, is directly related to casualty rates. Since lack of experience data on CBR casualties precludes predicting such rates, the amount of GRS support required cannot be predicted either. It is considered that the requirement for GRS support in CBR warfare will be on the order of three to four times greater. This is admittedly in the nature of a guess and is based only on the judgment of the author. It is not practical to organize and hold complete GRS units on a continuing standby basis just in case CBR warfare might break out. It is considered that a more realistic plan is to continue to provide the normal amount of GRS support presently programmed in Quartermaster GS and DS units. This should be backed up by providing trained technical teams (cadres), perhaps in the Army Reserve, which can be rapidly mobilized in case of CBR warfare and be augmented to operating strength by local labor, including military, from whatever sources possible and practical under the circumstances. **Shifting** GRS regular support from

one area to another to meet peak emergency requirements would tend to reduce maximum staffing requirements. However, in CBR warfare, it is not considered that this device will meet the considerably increased requirements and augmentation will be required as described above.

c. Special Training. GRS units will require special training in two major areas: CBR techniques and mass burial techniques. Officers and NCO's particularly, and perhaps some of the lower grades of enlisted men will have to be well trained in the use of radiac instruments and other CBR detection devices. They must also have a good working knowledge of the effects of CBR agents on areas, bodies, and equipment; of decontamination and disinfecting measures; of proper safety and preventive measures; and of the use of and necessity for adequate protective clothing. Training in mass burial techniques will be essential for CBR warfare and must be provided to GRS personnel and units. Recommended procedures are described earlier in this annex and in current literature.

12. Conclusions.

- a. Hit-and-run tactics and CBR warfare will generally prevent troop units from remaining behind to recover their dead. In addition, CBR agents, particularly nuclear agents, will contaminate areas and bodies for days to months and prevent recovery until areas become safe to enter for GRS operations. Under these conditions, recovery, identification, and evacuation will have to be done by Quartermaster GRS units, probably from Army rear area or COMMZ.
- b. BW and CW agents will present no severe problems to GRS operations. Bodies can be recovered and handled safely by wearing proper protective clothing, and observing the appropriate precautionary decontaminating and disinfecting measures prescribed in current doctrine and technical manuals.
- c. AW residual contamination (fallout and neutron induced radiation) will present serious problems. Areas will not be safe for entry of GRS personnel up to several months depending on weapon yield and distance from ground zero. As a policy, personnel should not be exposed to hazardous radiation to recover remains unless considered essential by competent authority for tactical, sanitary, morale, or other weighty reasons.
- d. If it becomes necessary to remove remains from hazardous AW contaminated areas, once the remains are removed, the contamination hazard is considerably reduced. If clothing is stripped from the remains, the contamination hazard becomes negligible and presents no obstacle to safe handling and processing of bodies, provided adequate protective clothing continues to be worn. This is also applicable to CW contamination.
- e. Adequate protective clothing for GRS personnel in handling CBR contaminated bodies and personal effects consists of the regular field uniform, gas mask or respirator under some conditions, and rubber gloves. Cloth or plastic "booties" worn over the shoes are desirable but not essential.
- f. With few exceptions, CBR contaminated bodies can be safely buried in the ground in the regular manner.
- g. The greater size of the field army area in CBR warfare, or warfare involving high mobility and wide disposition, will require more than one army cemetery.
- h. Certain personal effects, such as gold rings and jewelry, may become irradiated in a nuclear explosion and present a hazard to next of kin if returned to them soon and worn by them. Holding such articles for three months before returning to next of kin will remove the hazard.

i. All personal effects should be carefully decontaminated from fallout particles before being returned to the theater effects depot and the next of kin. Generally, this should present no significant problem. Careful monitoring with radiac instruments is essential with all personal effects. Effects that cannot be successfully decontaminated must be buried or disposed of per radiological safety requirements.

j. Mass casualty incidents can be expected to be a fairly regular condition in CBR warfare. Because of the large numbers of bodies resulting from such incidents, plus the frequency of occurrence, it will not be possible or feasible within bounds of military necessity to evacuate bodies. They must be buried on the battlefield, but outside the contaminated area, in mass graves using mechanical earth moving equipment.

k. Unless a quick simple identification method can be developed, it will not be possible to identify mass casualties prior to mass burial. Since identification is essential, it is urgent that such a method be developed.

l. No reliable estimate of overall CBR casualty rates can be made. It is considered that they will be substantially higher than those for conventional weapons.

m. GRS unit officers and NCO's will require training in use of radiac instruments and other CBR detection and identification equipment. They must also possess a working knowledge of CBR agents, their effects on areas, personnel, and equipment, and of decontamination and protective measures.

n. CBR type warfare, plus the hit-and-run tactics that it will involve, will require the great bulk of recovery, evacuation, and identification of the dead to be done by Quartermaster GRS units. Most of this is done in conventional warfare by troop units. Therefore, a very substantial increase in GRS support will be required in CBR warfare.

o. The type of GRS support and organizations required for CBR warfare will be basically similar to the conventional GRS organization and procedures. It will require the addition of the special training noted above, protective clothing, mechanical equipment for mass burials, and an improved identification method as described in this report.

13. Recommendations.

a. The present basic GRS organizational structure be retained for use in CBR warfare, but that personnel be given the specialized training recommended in c below.

b. Provision be made for rapid expansion of conventional GRS support in the event of CBR warfare by mobilizing trained technical teams, to be augmented by local or military labor, to handle the expected substantially increased workload that will result from use of mass casualty weapons.

c. GRS personnel be trained in the use of radiac instruments and other CBR detection equipment, in CBR contaminating effects, decontaminating methods, protective measures, and mass burial techniques.

d. Appropriate "damage recovery" equipment, as described in this report, be made up in standby kits for issue to GRS units for use in recovering bodies from rubble, blowdown, etc., in nuclear warfare.

e. Doctrine and standing procedures be developed for provision of adequate Engineer assistance in recovering bodies from rubble and blowdown, and for preparing and closing mass graves.

f. GRS unit TOE's have included appropriate radiac instruments and other CBR detection equipment for monitoring bodies, personal effects, and GRS personnel.

g. A quick, positive identification method be developed for rapidly identifying bodies in mass casualty situations. (See QMDO in annex C)

h. Personal effects that have been exposed to nuclear radiation be held three months before being returned to next of kin. Where peculiar contamination conditions preclude this, the items should be permanently disposed of in the theater per approved safety requirements.

ANNEX C

EQUIPMENT

1. General. Annexes A and B have pointed out the necessity or desirability for certain equipment to improve GRS operations. The various items are consolidated in this annex and described in detail. Where appropriate, QMR's or QMDO's are appended.

2. Trench or Grave Digger. This item is intended for use mainly at army cemeteries. Past practices of using hand labor are inefficient and depend heavily on use of indigenous labor which may not be available in fluid or CBR warfare. A piece of equipment capable of making a trench or grave 2 feet wide and a minimum of 2½ feet deep would meet the requirement. It is undesirable to burden the GRS unit with a separate piece of self-propelled excavating equipment. An item that could be attached to and powered by one of the organic vehicles of the GRS unit would be more practical. An example of this is the back hoe type of attachment that is commercially used as an attachment for jeeps and other vehicles. This item is readily available "off-the-shelf" and there is no need to develop a new military item. A digging rate of about 3 feet per minute would provide trenches for about 200 bodies in an 8-hour day. If one attachment cannot meet this rate, then several attachments should be provided rather than develop a new piece of special equipment. This item is not intended for use with mass graves; regular Engineer earth moving equipment is more practical for this purpose. As proposed elsewhere in this report, this should be obtained from the Engineers on a service basis as required.

3. Wrapping Sheet. In past conflicts the evacuation of remains from forward collecting points has been made in vehicles organic to the GRS units. CBR warfare will probably increase this requirement. It would be much more efficient and desirable to evacuate bodies in regular supply vehicles (and aircraft, if available) and thus reduce the number of organic vehicles in the GRS units. The principal objection to this in the past has been contamination of vehicles by body fluids that tended to leave a permanent objectionable odor in the vehicles. To overcome this and permit use of regular vehicles, it is proposed that a simple wrapping sheet be developed in which each recovered body could be wrapped and sealed against the escape of body fluids and odors while being transported to the army cemetery. The sheet should be inexpensive and disposable and be used as a burial shroud. It should also be strong, lightweight, moistureproof, opaque, puncture resistant, and self-sealing. It might perhaps be made of plastic or paper. Each wrap should be a single sheet and package about twelve to one cubic foot. It would replace the present pouch, human remains, and also the blankets, shelter halves, mattress covers, and similar items that are now frequently used in which to transport bodies and bury them. A QMR for this item is attached as Appendix 1.

4. Litter. The normal method of moving remains from place of death, at collected points, and within cemeteries is by means of a litter. It frequently requires four men to a litter. A wheeled, man-propelled litter would increase efficiency and save manpower. Two men would normally be able to operate this litter and it would reduce fatigue and promote greater production. It should definitely be man-propelled to avoid problems of maintenance, repair parts, and fuel consumption. A rollagon type of wheel might be advantageous for rough ground. Some commercial models or types of this item are available. Also, the Medical Corps has developed a prototype of such an item (QMR 1439d(18), CDOG, Lightweight Rollagon-Type Litter Carrier). Such an item should be included in GRS unit TOE's in suitable quantities.

5. CBR Monitoring Instruments. Annex B points up the necessity for adequate instruments of this nature to be used by GRS units in monitoring bodies, personal effects, and GRS personnel for CBR contamination. Some instruments are now available, particularly radiac instruments for detecting and measuring AW contamination, and improved ones are under development. This is generally true also of CW equipment. No adequate BW equipment is standardized yet but developmental work is in process. No unusual or special requirements for instruments are foreseen for GRS operations. The equipment that is now available or under development should satisfy the needs of GRS operations.

6. Automatic Body Locator. Location of bodies on the battlefield is very often a difficult and time-consuming task. A device that would automatically be activated upon a man's death and make known the location of his body would be highly desirable. Some type of signal emitter may be the thing. A requirement for an item of this nature for locating wounded men has been indicated by the Army Medical Service and a similar requirement has also been incorporated in the QMR for the thermalisium suit. An item developed under either of these requirements should prove to be satisfactory for GRS purposes.

7. Identification Method. Present GRS identification methods are quite positive and successful. However, they are laborious and require considerable time and skill. An improved or new method is needed that is quick and simple and will afford positive identification instantaneously. This is particularly essential for mass casualties. A desirable method, from the standpoint of identification, would be something that left a permanent mark on a portion of the body that would not decompose and that had a very high percentage of recovery. Examples of this are the thigh bone or the teeth. A mark on the exterior of the body is not acceptable because of loss by body decomposition and because of moral and religious objections. Also, this would offer little advantage over fingerprinting. A mark on the skeleton or posterior teeth would be much more permanent and would not be visible. Such a method would have to be quick, relatively painless, and done without surgery.

It must also be harmless to the individual. The mark could be in the form of a code or even a man's serial number. It must be of such a nature or substance that it can be easily read and recorded through the flesh by GRS personnel with the aid of a small hand X-ray or similar reading and recording device. A QMDO is attached as Appendix 2.

8. Damage Recovery Equipment. It is anticipated that use of nuclear weapons will cause many bodies to be buried beneath rubble, wrecked buildings and equipment, and blowdown. GRS recovery personnel will require equipment to assist in recovering such bodies. This will include such items as cutting torches, jacks, saws, axes, and digging tools. These items are presently in the military supply system and no developmental effort is required. Standby kits of such items should be made and held for issue to GRS units in case of nuclear warfare. Where cranes and other heavy equipment are required, such assistance should be obtained from the Engineers on a service basis as needed.

APPENDIX 1

ANNEX C

QMR FOR WRAP, HUMAN REMAINS (U)

Section I - Statement of Requirement

1. Statement of requirement.

a. Wrap, Human Remains (U)

b. (U). An expendable wrap, lightweight plastic or other materiel, opaque, moistureproof, puncture resistant and strong is required for the movement and burial of human remains. This size shall be adequate to encase a 250 pound body and will package 12 or more to approximately 1 cubic foot. The item shall be capable of simple closure in the field to insure an odorproof and moistureproof barrier. Concepts of future warfare indicate the need to evacuate remains from forward areas via supply vehicles and aircraft. This item will prevent contamination from odors and body fluids. It will replace pouch, human remains, a bulky item, and serve as a burial shroud, thereby saving blankets, shelter halves and mattress covers. (LR) Tentative CDOG subparagraph number is 1439_____.

Section II - Materiel

1. Performance requirements. This expendable wrap will be used to evacuate remains from the place of death. It will be moisture-proof and will completely wrap a remains to prevent the leakage of body fluids and odors from the package. It will be strong, opaque and will withstand handling and minor dragging when used as a wrap for a heavy remains. It will be lightweight to package 12 to not more than approximately 1 cubic foot. It will be suitable as a burial shroud.

2. Description of required equipment. The wrap will be moisture-proof, lightweight, and will package 12 or more to approximately 1 cubic foot. It will completely wrap the body of a large man and will prevent the leakage of fluids and odors from the package. The item will be strong and designed to permit handling of a remains of not less than 250 pounds without tearing. It will be puncture resistant from contact with brush, rocks, semi-sharp objects and will not be damaged by minor dragging of a packaged remains over the ground, gravel, sand or uneven surfaces. The wrap will be of a dull color that will conform with established camouflage practices. It will be capable of rapid, simple closure in the field without the need of special materials or devices.

3. Qualitative characteristics.

- a. The material will not harden, crack or become tacky at temperatures of minus 25 to plus 120 degrees fahrenheit.
- b. The material will be impervious to body fluids and odors.
- c. The material should be of such a nature as to permit decomposition of the body which it encases after being in the ground for a period of several months or so. Ideally, it should permit decomposition of the body without disintegration of the material so as to continue to contain the skeletal remains and prevent commingling with other skeletal remains in mass graves. However, this latter characteristic should not be achieved at the expense of increased weight and bulk, nor should it prevent proper decomposition of remains.

Section III - Operational and Organizational Concepts

1. Operational concepts.

Concepts of future warfare indicate the need to evacuate remains in returning empty supply vehicles and aircraft. It is necessary that the transport vehicles not be contaminated by body fluids or odors. The wrap, human remains will prevent contamination. The present pouch, human remains is bulky and presents a logistical problem in the forward areas. Remains are buried in blankets, shelter halves or mattress covers. The proposed lightweight wrap packed 12 to 1 cubic foot will greatly reduce the bulk problem of the pouches and serving as a burial shroud will eliminate the requirement for blankets, shelter halves or mattress covers for burial remains. Wrapped remains will be moved on a litter.

2. Organizational Concepts.

- a. QM Graves Registration personnel will use this item at forward collecting points, down to battalion level, throughout the evacuation channels, and at cemeteries.
- b. This item will be class II.
- c. Operational urgency. Operational availability should be achieved by Fiscal Year 1966.

Section IV - Maintenance Concepts

None required.

Section V - Background Information

1. Background information.

- a. References to CDOG General Objectives:

1410b(4)(d)

b. References to pertinent guidance and studies:

(1) "Graves Registration Operations Under Concepts of Future Warfare" (QMCCD 56-9), The Quartermaster Board.

c. Feasibility of development. The state-of-the-art regarding the development of plastics and similar materials indicates that it appears feasible that a wrap, human remains with the desired characteristics can be developed.

d. Maintenance and supply implications.

There is no maintenance problem. Supply problems will be improved by the use of this lightweight wrap replacing a bulky, heavy pouch and blankets, shelter halves and mattress covers used for burial.

e. Training implications. None.

f. Personnel implications. None.

g. Other items or systems that may be affected by this item. It will eliminate pouch, human remains and the requirement for the use of blankets, shelter halves or mattress covers for burial.

h. Cover and deception implications.

The wrap, human remains will be opaque of a color that will blend with the earth and earth covering.

i. Additional pertinent comments.

It is believed the new item will generate savings of funds, be more efficient and will be considerably less of a burden on the supply system.

Section VI - Recommendation.

The QMR is not sufficiently detailed to serve as a MC.

APPENDIX 2

ANNEX C

QUALITATIVE MATERIEL DEVELOPMENT OBJECTIVE FOR IDENTIFICATION OF REMAINS

1412j. (UNCLASSIFIED) Identification of Remains. There is a need for a means to simply, quickly, and positively identify deceased personnel even though remains, when recovered, are skeletal.

Justification and Supporting Information.

1. Prompt, positive identification of the dead is perhaps the most vital aspect of graves registration operations. At the same time, it is often the most difficult to accomplish. Identification is essential because of many considerations. In addition to the continued bereavement of the family when an individual is listed as missing in action for an extended period, the legal implications become extremely involved. Insurance claims cannot be paid, estates cannot be settled and the widow cannot remarry, to mention but a few considerations. Another factor is the cost to the government, as the pay and allowances of an individual missing in action continues as long as he is in this status.
2. Prompt recovery of remains by personnel of the unit sustaining the loss in most instances results in positive identification. It must be recognized, however, that in CBR warfare of the future the tactical situation may not permit combat troops to recover their dead. "Hit-and-run" tactics and the employment of chemical, biological and nuclear weapons will prohibit combat troops from remaining in an area to perform search and recovery operations. Under these conditions remains will be recovered by teams of graves registration personnel in the post combat phase of GRS activities. If the battle area is contaminated with radiation from a nuclear weapon, recovery of remains may be delayed for a period of a few days to several months. Identification of remains which have not been recovered for some considerable period of time is a laborious, time-consuming task requiring trained technicians and special facilities. Identification by this method will be impossible if mass casualties are sustained. Unless a quick and simple method of identification is provided, there can be no attempt at identification of mass casualties prior to disposal of the remains.
3. One possible solution to the problem, if technically feasible, would be to permanently mark a major bone in the body with some identifying symbol. Another possibility is to place an identifying mark or serial number, perhaps in miniature, on the buccal surfaces of one or more posterior teeth. Either procedure would have to be simple, relatively painless, leave no unacceptable external mark on the body, and take no longer to administer than it now takes to fingerprint.

4. In conjunction with these identification methods, there will be a requirement for a simple, light, durable, portable hand device that can be carried by GRS search and recovery units to enable them to automatically read and record the identification code on the bones or teeth of the deceased. Since the bones may still be covered with clothing and/or flesh, the reader must be able to penetrate these substances and inscribe the identification on a recorder which is an integral part of the reader, similar to the principle employed in X-ray equipment. When GRS units are recovering bodies from areas contaminated by fallout or are conducting mass burials in such areas, speed will be imperative. Even after the contaminated area becomes sufficiently safe for these operations to be conducted, there will still probably be some small lingering radioactivity which could constitute a possible internal hazard to personnel. Therefore, both the identification method and the means for reading it must be of such a nature that they can be recorded instantaneously. An indication should be incorporated into the device to show when recording has been satisfactorily completed.

ANNEX D

PERSONAL EFFECTS

1. General. Present policy, regulations, and international agreements require that personal effects of deceased personnel subject to military jurisdiction, both friendly and enemy, be collected, identified, and returned to next of kin through appropriate channels. This is supported by a long record of history and tradition having been first inaugurated by the U. S. Congress on 20 September 1776 in the Original Rules and Articles of War.¹ The practice has been continued through all major U. S. wars. The discussion in this annex pertains to personal effects of both U. S. and enemy deceased personnel. Personal effects of enemy personnel will be recovered and evacuated in the same manner as that prescribed in the handling of effects of U. S. citizens. After processing at depots in the COMMZ, the effects of enemy personnel will be disposed of in accordance with the rules of land warfare. Recommendations pertaining to limitation on personal effects which an individual is authorized to have in a theater of operations are, of course, applicable only to U. S. and allied personnel.

2. Nature of Personal Effects. Personal effects consist of two general classes: 1) the items that a man usually carries on his person such as wallet, ring, and wrist watch; and 2) other personal items that might be considered as baggage and which are usually carried in the man's unit such as extra clothing, toilet articles, and other personal items.

3. Implications. Very frequently, personal effects of either or both classes have substantial intrinsic value or else significant sentimental value to next of kin. Past experience, particularly in WW II and Korea, has shown that return of personal effects is usually desired and frequently demanded by next of kin. The military departments have experienced many problems with these personal effects, both directly with next of kin and as a result of Congressional intervention caused by complaints of their constituents when such effects have not been recovered and/or returned promptly.

From a military standpoint, the personal effects carried by a man are frequently of significant value as aids in identifying the body. Identification tags alone are not considered conclusive evidence of identification of remains. However, when they can be supported by personal identifying media, such as ID cards in a man's wallet, or engraved rings and watches, identification can generally be considered as much more positive.

1. The Quartermaster Corps: Organization, Supply, and Services. US Army in WW II, Vol II, DA, 1955.

4. Current Procedures. Present GRS practice regarding personal effects requires that those found on or near the body be recovered and evacuated with the body. If the body is buried in the temporary army cemetery, the items are carefully inventoried and recorded, used to assist in identifying the body, and then removed from the body. They are then forwarded through channels to the theater effects depot for eventual return to next of kin. If it is necessary to bury the body on the battlefield, such as in a hasty or isolated burial, the effects are buried with the body. Later, if the body is recovered, personal effects exhumed with it, are returned to next of kin, after identification processing as described above. The effects that a man may leave behind in his unit, when he becomes killed or missing, are sent through channels to the effects depot by the man's unit commander and are eventually returned to next of kin.

5. Tonnage and Manpower Considerations. In terms of tonnage and man-power, handling of personal effects of deceased and missing personnel does not constitute a significant burden on the theater when compared with other logistical functions. The total tonnage involved is substantially less than the tonnage of one week's supply of rations to a conventional field army. During World War II, the total number of personal effects processed for deceased, missing, prisoners of war, and interned personnel was 370,000 units. This amounted to 4,300 long tons.² The peak personnel strength of effects and baggage depots in the European Theater during this period was 355 military, 1,186 civilian workers, and 412 prisoners of war.³ This includes personnel required to handle personal effects of wounded and hospitalized personnel as well as the unaccompanied, unclaimed, and lost baggage not connected with GRS operations. The following table⁴ shows the relation:

Category	Units Processed	Cubic Feet	Long Tons
Personal Effects (Deceased, Missing, Prisoners of War, and Interned)	370,000	480,000	4,300
Personal Effects (Wounded and Hospitalized)	310,000	465,000	4,200
Baggage (Unaccompanied, Unclaimed, and Lost)	280,000	560,000	5,040
TOTAL	960,000	1,505,000	13,540

2. The Quartermaster Corps: Organization, Supply, and Services, US Army in WW II, Vol II, DA, 1955.

3. Ibid.

4. Ibid.

It is evident from the above table that the personal effects of deceased and missing personnel constituted less than a third of the tonnage and space requirements of all classes of baggage and personal effects during World War II in the European Theater. In terms of bare figures and logistical effort, they were relatively inconsequential. They generally were considerably less of a problem to the theater than the personal baggage of the living.

It does not appear that the transportation and physical handling of personal effects will be a significant problem, except for pilferage. Only small tonnages are usually involved at any given time, and incidences and densities are spread over both a period of time and a wide geographical area (casualties occur at varying intervals among different units in a total field army). Therefore, these items can generally be evacuated on regular supply vehicles that are returning rearward. The same is true of ships returning to CONUS for return of effects to next of kin.

6. Command Attitude. Information obtained from a survey of more than 200 experienced combat commanders of WW II and Korea indicates that the handling of personal effects by troop units did not represent a serious problem and very few suggested that the practice be discontinued. It was generally not considered to be more than an annoyance by the majority of the respondents, but one that was considered necessary.

7. Personal Effects in Future Warfare. It is not considered that there will be any change in military policy or public attitude regarding return of personal effects unless military necessity and conditions of warfare force such a change. This is considered likely to occur to some degree in CBR warfare but not in conventional-type warfare. Annex B points out that CBR warfare will likely create frequent situations requiring battlefield mass burials. It is questionable if there can be much recovery of personal effects under such conditions. There will probably be some radiation hazard present to GRS personnel under these conditions, and speed in making the mass burials will be essential. Therefore, very little time can be devoted to recovering personal effects in these cases. Such effects as can be picked up will be interred in the common grave with the bodies. This will, of course, preclude early return to next of kin. Even upon later exhumation of the bodies, it is doubtful that there will be much that can be identified and returned to next of kin in the way of personal effects. Neutron irradiation of certain items of gold jewelry is a special consideration in nuclear warfare and is treated in annex B. Where mass burials are not required in CBR warfare, personal effects carried by deceased personnel can probably be recovered and returned when it becomes safe (from contamination) to recover bodies. After decontamination of the personal effects (see annex B), if found necessary, they can be processed in the usual manner. In both of the above situations, effects left in the man's unit will be returned to next of kin.

8. Main Problems. The principal problems with personnel effects, aside from the special implications of CBR effects discussed in annex B, seem to be the following:

a. Identification of effects to insure correct ownership with relation to deceased personnel.

b. Insuring that all effects are recovered and returned to next of kin or otherwise satisfactorily accounted for.

c. Prevention of pilferage at the recovery level and in the various stages of evacuation and return.

d. Insuring that effects are returned promptly to next of kin and before arrival of the body (as in a concurrent return program).

Solution of the above problems would assist materially in improving the personal effects function, particularly from a standpoint of public relations. Also, any improvement in procedures that would minimize or reduce the logistical effort or permit greater application in CBR warfare would contribute to the effectiveness of the overall function.

9. Conclusions.

a. Military policy and public opinion will require a continuance of the practice of recovering and returning personal effects to the extent possible in future warfare.

b. Recovering and evacuating personal effects were not considered a serious burden to troop units by combat commanders in the past.

c. Logistically, personal effects are not a relatively serious problem to the theater.

d. CBR warfare, with its attendant mass burial situations, will seriously impair the ability to recover and return personal effects.

e. Improvement in personal effects control and discipline is required to aid in solving existing problems.

f. CBR warfare will cause special problems in handling contaminated irradiated personal effects.

10. Suggested Improvements. Some suggestions for possible improvement of existing procedures and partial amelioration of the above problems are presented.

a. The military departments determine what constitutes permissible personal effects and publish a policy that only authorized items (whenever possible) will be recovered and returned.

b. Permit only field uniforms -- no dress or Class A uniforms.

c. Return authorized personal effects in locked CONEX containers to reduce pilferage.

d. Observe the precautions prescribed in annex B for contaminated or irradiated personal effects.

ANNEX E

ADVANCED CONCEPT FOR GRS OPERATIONS

1. General. The concept proposed in this annex is intended for the very long range time period (1970-1975) and beyond. It tends to be in the realm of ideation and the total concept is not within the bounds of technology, either present or projected for the next ten years. It is intended to provide some thoughts that may possibly serve as future goals or provide a basis for basic research.
2. Setting. The type of warfare to which this concept would be applicable would involve hit-and-run tactics, high mobility, wide dispersion, and use of CBR mass-destruction weapons with resulting mass casualties and contamination of areas and bodies.
3. Concept. A tiny capsule is imbedded in the body of each soldier which is activated by the cessation of his body processes when he is killed. It sends out a continuous emission notifying of the location of his body and also giving a code identifying the individual. GRS search and identification is done by sending a remote controlled Ground Effects Machine (GEM) into the area where the deaths occurred. The machine has a tracking device which guides the GEM to the body by following the signal from the men's capsule emitter. The GEM automatically records the men's identification as picked up from the code emitted by the capsule. Two-way radio and television enable a remote operator to direct and maneuver the GEM. When the body has been located and the identification recorded, the remote operator causes the GEM to destroy the body with a disintegrator tube mounted on the GEM. The fact that bodies may be in bunkers or tanks, or buried under rubble, will present no obstacle to this method. The capsule emitter will give the location and identity of the hidden body and disposition can be made simply by disintegrating the tank or rubble along with the body. By reason of the GEM being remote controlled, it can enter a CBR area almost immediately after explosion.
4. Advantages. This concept would provide for location and positive identification of all bodies and reduce missing-in-action (MIA) cases to a minimum. It would eliminate the tremendous logistical problems of search, recovery, identification, and evacuation otherwise required; reduce GRS personnel to a handful of machine operators; eliminate sanitation problems; eliminate a lot of equipment and transportation; and save very considerable sums and effort that would otherwise be expended on repatriation activities.
5. Acceptability. It is believed that this method would be more acceptable to the soldier and public than the alternate of leaving bodies to decompose on the contaminated battlefield until it was safe to make entry and then perhaps being forced to inter them in a common grave.

ANNEX F

IMMEDIATE APPLICATION

1. Purpose. The purpose of this annex is to specify those portions of the graves registration system proposed in this study which can be implemented in the immediate future.

2. Discussion. Although the GRS system developed in this study is designed to support military operations during the 1965-1970 time period, the majority of the procedures proposed are applicable to immediate implementation. The only recommendations which are not susceptible to immediate adoption are those which require the development of a new item of equipment. In this connection, the recommendation that regular supply vehicles be used to evacuate remains is not practical until the plastic sheet, recommended in the equipment annex, is developed and made available.

3. Recommendations for Current Application.

a. That doctrinal guidance establish a policy that the commanding officer of the lowest organizational element (company) be responsible for initial recovery and evacuation of remains only as permitted by tactical requirements of his primary mission.

b. That all troops receive, as part of their unit training, instruction in search and recovery procedures and the importance of safeguarding personal effects.

c. That training of all GRS specialists include instruction in operation of radiation and other CBR detection and measuring equipment and proper procedures in handling of contaminated remains and personal effects.

d. That doctrine be established for provision of adequate Engineer assistance to GRS units when such assistance is required.

e. That appropriate "damage recovery" equipment, as described in this report, be made up in kits for issue to GRS units in CBR warfare.

ANNEX G

COORDINATION

SECTION I - GENERAL

1. Introduction. Copies of the report draft were sent to 22 agencies for review and comment and responses were returned by all. All respondents concurred in the concept and general system, but some took exception to certain specific items, while others suggested certain improvements and refinements of the proposed system. In those instances where the Board agreed with the comments, changes to the report were made accordingly. This is also true of editorial comments in general. Certain other comments were not considered significant or else desired inclusion of detail which the Board did not consider appropriate in a conceptual study such as this. Significant specific comments are discussed in paragraph 5 below.

2. Special Review. A copy of the draft was sent to the Atomic Energy Commission for review of the technical content of the study, particularly annex B. With the addition of some minor refinements, the Commission concurred in the study and made the following general comment: "This office is particularly pleased to see efforts expended in this direction. Needless to say, it certainly is a step in the direction of future preparedness. Generally, the document denotes good thinking."

3. General Comments. A number of comments pointed out what were considered to be omissions in the proposed system, such as the exercising of proper reverence in handling the dead, continuing the use of the current metal identification tags, using dentures for identification, and similar features which are standard graves registration policies and procedures. As the study points out in the very beginning on page iii, paragraph 2, the study examined the application of present graves registration policies and procedures to future tactical concepts and proposed changes only where such were found necessary. On this basis, it was not considered necessary or desirable to include in the study report all those standard graves registration procedures and policies that are now in use and that can be continued in whole or part in the future. The study also stresses the point that as a policy, normal GRS practices will be followed to the degree feasible under existing conditions. The new features contained in the report are designed mainly for those conditions under which normal GRS practices are not practical or are impossible. It should continue to be the policy to recover and handle our dead with the fullest reverence and in accordance with our best traditions to the maximum extent permitted by circumstances and military necessity. Continuation of such a policy is borne out by the feeling of the responses to a questionnaire which had been sent out during the course of the study to senior combat-experienced arms officers.

More than 200 of these officers returned completed questionnaires and none of them indicated any deviation from the above policies as a GRS objective. One brigadier general stated that we should fight to recover our dead in retrograde actions.

Only one recommendation in the draft received a large amount of general comment. This was the one dealing with making the division GRS element organic to the division rather than an augmentation as is now the case. Of the seven respondents commenting on this point, three were pro and four con. Significant extracts of their comments appear below:

Armor School: "The Armor School is of the opinion that the GRS platoon should be organic to the division provided that the strength of the Supply and Service Company, Armored Division Supply and Transport Battalion, TOE 10-7E (draft), is increased the required number of spaces."

Army War College: "USAWC concurs that the GRS elements should be authorized as an organic unit of the division rather than on an augmentation basis but feels that its staffing during peacetime should be limited by a TOE reduction table to only key technical specialists in order to conserve personnel."

US Army, Alaska: "It is agreed that the GRS unit should be organic rather than attached to the division. However, the size of the unit required on the future battlefield should be made a subject of further study. It is recommended that a CDEC experiment be conducted to determine the optimum size of a GRS unit at division level * * * *."

Artillery & Missile School: "The present concept of furnishing GRS personnel on an augmentation basis is believed valid, and it is not considered necessary to make such personnel organic to the division."

Command & General Staff College: "There is no valid requirement for an organic division GRS platoon. The present system of providing the platoon as an augmentation is sound. Improvement can be made, however, in the training program of GRS personnel. It is suggested that advanced individual (MOS) GRS training continue to be performed by the Quartermaster School. This training should be extended to include formation and training of division GRS platoons at the Quartermaster School. Basic GRS unit training can be done more efficiently and economically at the Quartermaster School because of better supervision, better facilities and instructors, and uniformity of instructions and procedures. Upon completion of Basic Unit Training these platoons should be assigned to divisions when authorized by higher headquarters. Whenever possible platoons of trained GRS personnel should join divisions in time to participate in advanced unit training of the division Quartermaster Company and larger sized exercises."

Infantry School: "The organizing and training of Graves Registration Service units can be accomplished regardless of whether they are organic, attached or in support of a division. In fact, the division could offer little toward the realistic training of these units. Additionally, the division authorized strength ceiling precludes the organic assignment of many functions required by the division when engaged in active combat. Such activities include civil affairs, prisoner of war interrogation, Army Security Agency and communication and electronic intelligence. United States Army Infantry School is of the opinion that Graves Registration activities are in the above category and no change in the current system of augmentation is required."

Army Medical Service: "Nonconcur. GRS personnel on an augmentation basis can accomplish their mission. Required troop training (i.e., reporting, identification, etc.) can be incorporated and emphasized in unit training."

Board Discussion: It is significant to note that all the arms combat development agencies commented on this point: Armor and AWC pro and Inf, Arty, and CGSC con. Although the nonconcurring comments total only four out of a total of 22, since three of them are from arms agencies they merit considerable attention. Nevertheless, after consideration of all factors involved, the Board continues to believe that the division GRS element should be organic to the division. The records of the early days of World War II show a serious paucity of trained GRS elements at division level. This resulted directly in loss of many identifications of remains and in a general lack of adequate GRS procedures, due mainly to a lack of knowledge on the part of the combat personnel. Another very undesirable feature was the necessity for diverting combat troops to perform this job when GRS personnel were not provided. Later, when trained GRS elements were assigned to divisions, the situation improved greatly. The significant fact here is that in past wars, and undoubtedly this will be true in future wars, when the GRS element is not organic to the division, it simply does not seem to be available at the beginning of hostilities, and this is a time when GRS personnel are needed critically. It is to eliminate this deficiency that the Board makes its recommendation for an organic GRS element in the division.

SECTION II - SPECIFIC

4. Introduction. The great majority of the specific comments received from other CD agencies suggested refinements to improve the proposed system, to clarify certain points, and to improve accuracy. In most cases, these comments were valid and helpful and were incorporated into the report. Examples of such comments that were accepted follow:

(a) Adjutant General's Board: "As an interim measure it is recommended that consideration be given to the development of a suitable individual container for identification documents which would guard against their deterioration while the remains are exposed awaiting the time when a contaminated area may be entered or when military necessity absolutely dictates mass burial with little or no identification effort."

(b) Command & General Staff College: "Recommend the study use approved terminology in reference to nuclear radiation found in DA Training Circular 101-3, Nuclear Radiation Terminology, 16 Jan 61." (Note: This provides for the use of the term "rad" instead of "roentgen, rep, or rem".)

(c) Ordnance Board: "The marking of a major bone of the body for positive identification is considered practical. However, it would appear that at least two major bones of the body should be marked."

(d) Transportation CD Group: "Would not the last 4 numbers of a person's serial number plus his last name chemically etched into the belt buckle serve this purpose?" (Note: This had to do with the Board proposal to stamp an individual's identification on his belt.)

(e) CmlC Field Requirements Agency: "CBR is not defined the same in these two paragraphs. It is recommended that the definitions conform with that in AR 220-58." (Paras e on page 3 and 4 on page B-5)

"Recommend changing sentence to show that only a few chemical agents produce a hazard that persists as long as a few days. (Para 5a on page B-6.)

5. Specific Comments. Some of the specific comments took exception to certain parts of the study or, in one or two cases, suggested major improvements. These are discussed more fully below.

(a) US Army, Alaska.

Comment: "Do not concur with the statements: 'The unit sustaining the loss (company) will evacuate remains to the next higher echelon (battalion) if this action will not interfere with its primary mission. If it is not feasible for the company to evacuate remains the service element of the battalion will evacuate from point of recovery to the QM collection point at brigade level.'

Reason: The company does not have transportation for evacuation of remains. This is not a function of the company even when it does not interfere with the primary mission. Collection of remains within the company can be accomplished to a certain degree, depending upon the tactical situation, and the remains could be located at a central point within the company zone. Removal to battalion or other higher echelon must be accomplished by the higher echelon. QM Graves Registration personnel or teams should operate from the company to higher echelons."

QM Board Discussion: Current doctrine, as set forth in paragraphs 5 and 38 of FM 10-63, Handling of Deceased Personnel in Theaters of Operations, July 1959, places the initial responsibility for recovery and evacuation of deceased personnel on the commanding officer of the lowest organizational element -- the company. However, the problems that beset the unit commanders in attempting to discharge this responsibility in combat situations are recognized by the Board in the study. The problems are pointed out very strongly in the responses to a questionnaire which the Board sent to more than 200 senior, combat-experienced arms officers. Over 95% of the responses indicated that the current GRS system was considered practical and workable under most circumstances (for conventional type warfare). The principal change recommended was that company commanders be given more latitude in action they will take regarding GRS operations. In general, the comments pointed out that the company commander should and can recover and identify his dead, but that in many instances, it is very difficult if not impossible for him to evacuate the bodies without jeopardizing his tactical mission. A large number of questionnaire responses proposed that evacuation of the dead be a responsibility of battalion or higher command echelon. They said that all the company commander can do in some phases of active combat is to recover the body, identify it, and move it to the axis of advance where it will be found by support elements of the next higher organizational element. It was pointed out in the responses, however, that this condition is true only for front line troops (infantry and armored) in attack. Support troops, including artillery, can usually evacuate their dead, and infantry and armored troops can also evacuate in a stabilized or defensive situation. In spite of the above considerations and problems, historical experience shows that the great bulk of remains have been evacuated to battalion collecting points in our past wars by units at the company level. Another consideration is the additional number of GRS or other service troops that would be required if units were to be relieved entirely of evacuation responsibility. Therefore, after considering all the factors involved, the Board concluded that a compromise afforded the best solution under the circumstances. This resulted in the recommendation that current

doctrine be modified to charge the unit commander with evacuation responsibility only when the tactical situation permitted. This would afford him the flexibility he requires and which current doctrine does not now provide. It would also require him to perform the evacuation task whenever possible which would reduce the number of supporting personnel that would otherwise be required if he were relieved entirely of this responsibility. The above solution appears to be in consonance with the opinions expressed in the questionnaire responses and tends to be compatible with USARAL's comment although not quite to the degree expressed by USARAL.

Comment: "The study appears to be incomplete insofar as it pertains to graves registration operations, evacuation of remains, and burial in cold weather areas. * * * It is recommended that additional study be given to GRS operations to establish procedures for handling remains in northern areas in winter."

QM Board Discussion: The Board recognizes this. However, the instant study is a combat development study designed to support the general tactical and logistical concepts developed by the Department of Army under the Army Combat Development program. This study does not include support under special environmental conditions. The Board contemplates including in its future program studies for providing Quarter-master support under special environmental conditions.

(b) Chaplain Board.

Comment: "In general methods, procedures, proposed QMR and QMDO of this intensive study appear to be sound. * * * It may be in order to observe that nowhere in the study is any indication given that Graves Registration procedures pertaining to the recovery, identification, and burial of the dead will be conducted with traditional reverence and the respect for the deceased."

QM Board Discussion: See paragraph 3 above. To avoid possible misinterpretation of the intent of this study, a statement has been added to the summary, paragraph 2, page iii, as follows: "As a policy, standard GRS policies and procedures will continue to be applied and remains will be recovered and handled with the fullest reverence and in accordance with our best traditions to the maximum extent permitted by circumstances and military necessity."

Comment: "The recommendations in the draft that an identifying symbol be placed on the bone structure of a person, though it may not have immediate implications that would draw the ire of major religious faiths, yet is so similar to the marking of the Jews in the Nazi regime and reminiscent of Dachau and Buchenwald as a totalitarian technique that it will continue to be remembered as such."

QM Board Discussion: The proposed method met with wide acceptance among the respondents to the questionnaire noted under para 5a above. Also, only two of the twenty-two agencies commenting on the study took exception to this technique -- the Chaplain Board and the Army Medical Service (see para 5d below). Although the proposed method may not be the most desirable or the best, it points up the widely accepted recognition of the necessity and urgency for a quick, simple, positive identification method for CBR warfare. The alternate method proposed by AMEDS may be equally effective and more acceptable. If so, it would be entirely acceptable to this Board and has been included in the recommendations of the study.

Comment: "This agency would question the suggestion of an apparent breakdown of combat discipline which would tolerate nuclear strikes to kill several thousand troops in tactical areas. It is contrary to the dictates of warfare in the middle and long-range periods which do not envisage heavy concentrations of troops."

QM Board Discussion: Nonconcur with first sentence. See para 9, annex B of study.

Comment: "The philosophy in existing regulations, specifically AR 638-40, paragraph 30, A, "Utilize every possible means to effect recovery of deceased personnel" advocates avoidance whenever possible of burial of unidentified dead. This is more in keeping with the belief and human values of our form of society. Mass burial in the current regulations does not deny or obviate the necessity of attempting identification and relying on established procedures to obtain recognition. It would seem preferable that the deceased be left "on site" for a longer period of time rather than that they be hurriedly engineered-using heavy equipment-like so much waste material, into the anonymity of hasty and mass interment."

QM Board Discussion: It is fully agreed that identification of remains should be effected to the maximum extent. The study considers this to be one of the most important features of GRS operations. Recommendations have been included in the study for improved, simple methods that will make it possible to accomplish identification quickly and positively even under CBR and mass burial conditions. It is true that bodies could be left lying in contaminated areas until it was safe to effect entry and recovery, and identification of remains could then be established, if possible. However, it is not believed that it will always be feasible

to do this. In some cases, perhaps many cases, it will become necessary to inter mass remains as quickly as possible in the interests of health and morale of the living troops, even though the area still provides some radiological hazard to the GRS personnel. Under these conditions, conventional identification and mass burial procedures become improbable. Development of identifying methods, such as those recommended in the study, become more urgent in view of the above.

c. Engineer School.

Comment: "Recommend that the intrenching machine, combat, high speed, wheel mounted, (FSN 3805-542-3054) be evaluated for digging graves in the Army area. * * * The machine has basically the same mobility as a 2½ ton truck and requires only two operators for a two-shift operation. One of the operators could be a mechanic responsible for organizational maintenance. * * * If the intrenching machine meets the QM requirements, recommend that this machine be organic to the appropriate GRS units. This will reduce greatly the manpower requirement for digging graves and preclude the development of another excavating machine to join the already large family of construction equipment."

QM Board Discussion: Nonconcur that the intrenching machine be organic to GRS units. There is no doubt that this machine can do the required job at the army cemetery efficiently and effectively. The drawback is that it is a large, complicated piece of machinery that will require considerable maintenance, parts, and attention. This is considered undesirable, as was pointed out in the study. The GRS staff and operating people consulted during the study favor grave digging equipment that is simple, light, requires a minimum of maintenance, and can be attached to ordinary organic vehicles. The study recommended such a piece of equipment in the form of a "backhoe" attachment that is readily available commercially in quantity. It is used extensively for digging, loading, and back-filling by highway department trucks, farm tractors, and commercial jeeps. There is no necessity for development of any new grave digging equipment, and the Board has modified pertinent portions of the study to emphasize and clarify this point.

d. Army Medical Service.

Comment: "Proper compliance with paragraph 101b(2)(a), AR 40-400, which requires that an Emergency Medical Tag (DA Form 8-26) be initiated and attached to the remains of KIA's should facilitate early positive identification at unit level."

QM Board Discussion: Concur, whenever this is possible. However, it is doubtful that it will be so in mass burial situations and in recovering badly decomposed or skeletal remains from radiologically contaminated areas after several weeks or months have elapsed.

Comment: "Nonconcur in use of 'returning supply vehicles' for evacuation of remains. Time required to move to a collecting site, load, move to area of dispositions, and unload. Repetition of these actions will occur prior to arrival at an Army cemetery and consumes too much time."

QM Board Discussion: Nonconcur. It is agreed that the cycle will require more time than if the supply vehicles simply returned empty. However, it is considered that the time will not be excessive and that it will be available. The additional effort required by the supply vehicles and personnel will be much less than would be required in providing separate special vehicles for this purpose.

Comment: "Concur a requirement exists for a quick, simple, positive means of identifying the dead. It is felt that no single method of identification would assure positive identification. Further, the approach of marking a major bone in the body is not considered practical medically." Recommendations: Further consideration in early identification of the dead by use of dental means:

- (1) Denture markings.
- (2) Imprinting a dye on the buccal mucosa.
- (3) Number markings on buccal surfaces of posterior teeth.

QM Board Discussion: The Board recommendation is intended to stress the great need for additional practical measures to assure a higher percentage of success in identifying remains. Although only one possible means, i.e., bone marking, was suggested, it is agreed that the R&E elements responsible for developing improved methods of identification should consider carefully all suggestions received. The Boards' recommendation is not meant to recommend one specific system to the exclusion of any other. Method 3 suggested by AMS appears to have considerable merit. Additional research on the part of the Board tends to support this. Therefore, this method has been included specifically in the recommendations of the study and in the proposed QMDO. The Board does not consider it as a substitute for the proposed bone-marking method at this time. Rather, it is recommended that research projects be initiated on both methods simultaneously to determine the feasibility of either or both. Moreover, the QMDO is written broadly to permit research in other promising areas as well.

e. Office of the Chief Signal Officer.

Comment: "General concurrence is expressed in the study, although serious reservations are held regarding the feasibility and practicability of using individual electronic emitters to locate casualties on the battlefield. There is no doubt that the placement

of an additional one or two hundred thousand devices of this type in the field army will contribute to the already difficult frequency problem as well as require the expenditure of a large sum of money. Accordingly, the use of such devices should of necessity be assigned a low priority in comparison to the command control communication system of the field army."

QM Board Discussion: The Army Medical Service has established a requirement for a device of this type for locating wounded personnel and has tested several prototypes at CDEC. However, the Board recognizes the validity of the above comment, particularly the implications to the total communications picture. Therefore, the study has been modified to indicate that if the Army Medical Service is successful in developing such a device for locating wounded personnel, the device should be designed to enable its use for locating deceased personnel also.

Comment: "Change para 1, page 31, to read: 'A research project be coordinated with the Medical Service, with the Chief Signal Officer, and the Chief, Army Security Agency, for the development of an individual signal emitter to aid in locating wounded and dead personnel.'"

QM Board Discussion: Concur.

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