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# AMSAA

TECHNICAL REPORT NO. 313

THE EFFECT OF CHEMICAL PROTECTIVE CLOTHING  
AND EQUIPMENT ON COMBAT EFFICIENCY

JOHN A. RAKACZKY

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U.S. ARMY MATERIEL SYSTEMS ANALYSIS ACTIVITY  
ABERDEEN PROVING GROUND, MARYLAND

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| 20. ABSTRACT (Continue on reverse side if necessary and identify by block number)<br>A need exists for specific, quantitative data pertaining to the degradation of individual and unit combat efficiency caused by the wearing of chemical warfare (CW) protective gear, i.e., mask, hood, gloves, overgarment, and overboots. The US Army Materiel Systems Analysis Activity (USAMSAA) has initiated a program designed to provide these data. This report describes the first portion of this program, the development of a viable data base which will enable meaningful and useful degradation data to be generated through the employment of computer simulations. |                                     |                                                                                               |

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## PREFACE

Computer simulations are used to evaluate doctrine, training procedures, equipment and occasionally to study current battlefield scenarios. In any future conflict there is the strong possibility that toxic chemical agents will be employed by opposing forces to achieve a tactical advantage. As a result, computer models are being modified or developed to study the effects that chemical warfare will have on military operations.

Among the duties and responsibilities of the Tactical Operations Analysis Division (TOAD) of the US Army Materiel Systems Analysis Activity (AMSAA) is the formulation, development, revision, or refinement of computer simulations, i.e., war games. One of the major areas of interest in a chemical warfare scenario, and which is addressed in very few of the current models, is the degradation of personnel efficiency resulting from the necessity to wear chemical warfare protective gear. To accurately and realistically evaluate the effects of degradation through modeling, a viable data base is a primary requirement to develop and/or validate a reliable model. AMSAA is attempting to develop this data base.

A draft interim note detailing the initial effort was distributed on a limited basis in mid-January 1981, along with a letter soliciting comments, criticism, guidance, data, etc. Responses received from this request have been incorporated, to the extent possible at this time, into the current report. Distribution of this report has been considerably wider than that of the draft interim note. As before, a request has been made for comments and suggestions, but the primary interest is in acquiring quantified data that is more recent, more reliable, and that more realistically reflect plausible combat conditions.

Information received will be incorporated into a revised report which is tentatively planned for mid-1982. AMSAA POC is John Rakaczky, DRXSY-TN, Autovon 283-4485, Commercial (301)-278-4485.

Previously distributed copies of the draft interim report dated 19 January 1981 should be destroyed.

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In addition, AMSAA wishes to recognize the contributions of the many officers at APG who participated in the construction of the tables listing the functions of the various Army branches, and particularly to CPT Andrew W. Knight, USATECOM, APG, MD, who prepared the entire table of Quartermaster functions and times.

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# THE EFFECT OF CHEMICAL PROTECTIVE CLOTHING AND EQUIPMENT ON COMBAT EFFICIENCY

## 1. INTRODUCTION

With the recent renewed interest in chemical warfare, there have been efforts to analyze the effects of this type warfare by means of models and/or computer simulations of battlefield scenarios. Part of these efforts have been addressed to the degradation of unit effectiveness as a result of having to wear and work in chemical protective gear.

The vulnerability of troops exposed to a toxic chemical agent environment can be reduced by donning protective clothing and equipment such as a mask, hood, gloves, overgarment, and boots. At the same time, however, wearing these items, particularly for extended periods of time and/or at high ambient temperatures ( $>80^{\circ}\text{F}/27^{\circ}\text{C}$ ), frequently reduces the efficiency of individuals performing their assigned tasks. This individual degradation can and does eventually reduce the overall combat effectiveness of entire units.

A large portion of the degradation of individual and unit efficiency can be attributed to several inherent characteristics associated with the individual items that comprise the chemical warfare (CW) protective ensemble. Specifically, these include the following:

- Heat stress or heat build up due to the weight and bulkiness of the overgarment. The lack of "breathability" of the overgarment also contributes to the heat build up.
- Respiratory stress due to the air resistance of the protective mask filters and outlet valves.
- Reduced dexterity in the forearm portion of the overgarment and reduced manual dexterity due to wearing gloves. Some loss of dexterity can also be associated with the overboots.
- Restricted vision and hearing (communications) due to mask design.

In addition, morale and psychological stress, which are functions of being under attack, are contributing factors to the general physical discomfort caused by the protective clothing. Of these, only heat stress has been investigated in depth or quantified to any extent, primarily through the efforts of Dr. Goldman and his associates at USARIEM (US Army Research Institute of Environmental Medicine). Quantitative evaluations of other factors affecting degradation have been rather limited.

The amount of degradation in unit effectiveness from heat stress caused by wearing CW protective clothing is a function of several variables. Among these are (1) the type and combinations of environmental and protective ensemble worn, (2) the environmental conditions prevailing at any given time, (3) the duration during which a specific ensemble is worn, (4) the level of labor or activity sustained during the time a specific ensemble is worn, (5) the physical state of the personnel at the time the CW ensemble is donned, and (6) the degree to which the unit is trained in wearing protective clothing.

The Army employs the Mission-Oriented Protective Posture (MOPP) system to protect personnel against chemical agent attack. This is a flexible system intended to serve as a guide to commanders and is designed to facilitate mission accomplishment. It "requires the soldier to wear individual protective equipment consistent with the chemical threat, the workrate imposed by the mission, and the temperature".<sup>8</sup> A tabulated summary of current MOPP levels is shown below.

TABLE 1 - DEFINITION OF MOPP LEVELS

| PROTECTIVE CLOTHING AND EQUIPMENT |                                           |           |                                                |          |
|-----------------------------------|-------------------------------------------|-----------|------------------------------------------------|----------|
| MOPP                              | OVERGARMENT                               | OVERBOOTS | MASK/HOOD                                      | GLOVES   |
| 1                                 | Worn, open or closed based on temperature | Carried   | Carried                                        | Carried  |
| 2                                 | Worn, open or closed based on temperature | Worn      | Carried                                        | Carried  |
| 3                                 | Worn, open or closed based on temperature | Worn      | Worn, hood open or closed based on temperature | Carried  |
| 4                                 | Worn, closed                              | Worn      | Worn, hood closed                              | Worn     |
| Baseline                          | Not worn                                  | Not worn  | Not worn                                       | Not worn |

This report will be limited to MOPP 4, full or maximum protection, and the baseline condition, which is no protective clothing at all (only the normal duty uniform consistent with a specific task and environmental conditions). Also, no attempt will be made to determine what portion of the total amount of degradation can be attributed to any specific item of the CW ensemble.

## 2. APPROACH/RATIONALE

Earlier attempts to model degradation reportedly have been inadequate, one of the major reasons being a lack of empirical data with which to validate the models. The US Army Materiel Systems Analysis Activity (AMSAA) has initiated a program designed to provide these data. The objective of the first portion of this program is to establish and develop a data base which can be utilized to provide realistic information regarding the tactical effectiveness of units in a chemical warfare environment by means of computer simulations.

The successful establishment of a viable data base would enable the accuracy and validity of previous modeling efforts to be determined. It might also serve as the basis for the development of an entirely new model. The demonstration of a reliable model with which to ascertain the realistic effects of degradation would reduce the need for a costly and time-consuming test program. Current doctrine, training, and equipment, as they relate to CW, need to be evaluated now, so that any modifications that are required could be initiated and implemented without undue delay (as is likely to result from an extensive test program). Subsequent tests and training exercises could be employed to refine and validate existing data.

A two-phased approach was employed in developing the data base. One phase involved the review of the literature to determine if results or data from any earlier tests or studies were applicable to this program. Examples of the specific types of information sought included the following:

- Tasks or functions normally performed by military personnel, as individuals or as units, in tactical situations;
- Times to perform specific tasks (see note below);
- The degree of protection, or MOPP level, employed by personnel while performing specific functions;
- Temperature conditions prevailing at the time the specific functions were performed;
- Any previous modeling efforts that might provide information that could be applied to this program.

NOTE: At this point in the program, time was selected as the primary parameter to be considered in determining any decrease in unit effectiveness because of the ease by which it can be measured, and because differences in time are readily comprehensible. In addition, time is a critical factor to be considered in the activities of any unit within the area of tactical operations. However, it is recognized that there are other parameters that can be employed to measure unit effectiveness. These include the probability of hit, rate of fire, target acquisition, effective ranges, etc. It is anticipated that these also will be studied later in this program.

Concurrent with the literature review, a survey (Phase 2) was conducted to obtain and catalog the major functions or tasks that various units within the different branches of the Army might be required to perform in tactical situations. The branches surveyed include combat, combat support, and combat service support types. Specifically, these were air defense, armor, artillery, aviation, chemical, engineer, infantry, medical, military police, ordnance, quartermaster, signal, and transportation.

Items of particular interest in this survey included the size and type of the unit (including personnel and vehicles), the specific major functions that these units frequently perform, and workload (heavy, moderate, light) or amount of energy required to accomplish these tasks. Examples of functions in which heavy workloads are required include the loading/unloading of ammunition by hand, a forced march, digging with hand tools, infantry in dismounted attack, etc. Moderate workloads are exemplified by tasks such as infantry in dismounted defense, activity normally associated with units in reserve positions, some reconnaissance missions, certain maintenance operations, etc. Light workloads usually imply activities such as administrative tasks or motorized movement. In addition, the times required to perform these functions without chemical protective equipment were obtained. The times assumed relatively ideal conditions, e.g., daylight, moderate weather, trained troops, etc.

The majority of information (function, workload, times w/o CW gear) was obtained through interviews with officer personnel of rank O3 to O6 assigned to the various APG activities (AMSAA, TECOM, OC&S, MTD). The manner in which this was done was to (a) select officers from the different branches represented on the personnel rosters of the activities, (b) have discussions with as many from each branch as practical, then (c) prepare tables as shown in this report based upon these discussions. The information was essentially first hand in that these officers had commanded units that performed these specific tasks. The times were those they considered to be reasonable to accomplish the task (w/o protective gear), times they would accept as the commanding officer of the unit. The higher ranking officers displayed more experience in more diverse areas; the lower ranks had more recent, albeit limited, experience. In some instances, the officers interviewed had participated in the preparation of ARTEPs (Army Training and Evaluation Programs). Others had participated in training exercises in which CW protective gear had been worn. (Although they were not able to provide any quantitative data, they did provide some valuable opinions and estimates of the effects of CW protective gear.) Additional or supplementary information was obtained from the appropriate FMs (field manuals), TMs (training manuals), SQTs (skill qualification tests), and ARTEPs.

The tabulated data obtained in this manner to date are given in Tables 2-14 (first 5 columns). Briefly, this information includes the following:

- o The type and size of the unit of interest;
- o The major functions performed by the unit (along with a descriptive or qualifying phrase where applicable);

- o The level of workload required to perform the function;
- o The amount of time that could reasonably be expected to be taken to accomplish the function, without any protective clothing (wearing only the normal duty uniform in keeping with task requirements).

Times shown for performing tasks without protective clothing assume relatively ideal conditions of daylight, moderate weather, trained troops, etc. It was also assumed, again where no CW protective gear is worn, that there would be no difference between the time required to perform a specific task at temperatures near 20°F than it would at moderate temperatures (~60°F). The fact that wearing cold weather clothing in itself (w/o CW gear) may influence the performance of personnel not considered at this point in the program. As data become more refined, however, this may need to be addressed.

### 3. RESULTS AND DISCUSSION

After several documents were reviewed<sup>10-18</sup>, it became apparent that there was a paucity of quantified information concerning the degradation of unit effectiveness as a result of wearing CW protective equipment. Much of the data were of a subjective nature and therefore were considered to be of limited validity and applicability. Test conditions varied and were sometimes uncontrolled, thereby making comparisons difficult.

A detailed review of all the documents examined will not be presented here. However, it should be noted that two recent reports<sup>19,20</sup>, published subsequent to the initiation of the work described herein, provide excellent summaries of previous chemical performance testing. The first of these<sup>19</sup> presents the results of a literature search made to examine the effects of the use of chemical protective clothing and equipment on mission performance. From the list of reports reviewed, several were selected for further analysis. A critical assessment of these tests was made and the findings reported in Reference 20.

Some of the major points of this assessment<sup>20</sup> include the following:

- There was no uniformity in the structure of the tests, the parameters they attempted to measure, or in the manner in which performance was measured. This was attributed to the fact that the tests were performed over a period of 20 years, were conducted by different organizations, and were conducted under different technological and military conditions.
- The greatest amount of data is available for infantry missions and tasks, and cover attack, defense, and retrograde operations for squad, platoon, and company size units. A disadvantage is that most of the data are presented in terms of staytime, the length of time an individual remains in protective gear until he becomes a

casualty or until the unit becomes ineffective because of heat stress.

- The duration of most of the tests was too short to be able to assess the effects of rotation of individuals or tasks to maximize unit effectiveness over time.
- There are almost no data for a tank company or battalion.
- Artillery data are limited. There was no live firing, and the scope of tests was limited.
- There was little or no data for any specialized type of combat, such as airborne operations, river crossing operations by engineer units, etc.
- No data were available for cold weather conditions, or for operations over rough terrain or in deserts.
- No extensive testing was done over a variety of MOPP conditions.
- No tests were reported in which females were included.

A review of the literature, specifically those reports in which previous efforts to model degradation were described<sup>11</sup>, 21-23, also indicated that each model had some limiting factors that generally restricted, or qualified its use. The principal deficiency most frequently mentioned was the lack of sufficient empirical data with which to verify the model or to determine its accuracy. As an attempt to provide this type of data, Tables 2-14 were developed.

Since the desired data were not available from traditional sources (results of field tests, training exercises, recorded but unpublished test results, etc.), it was necessary to calculate the time required to perform various functions while wearing full CW protection (MOPP 4). Calculations were made for three different temperatures, as indicated, and the results entered in the appropriate column.

The bases upon which these calculations were made are provided in Tables 15 and 16. Table 15 gives work/rest values extracted from FM 21-40.<sup>8</sup> These data are intended to serve only as a guide to commanders to enable them to carry out their assigned missions with a minimum or negligible number of heat casualties. It should be noted that the indicated rest periods are those needed to allow an adequate amount of cooling time for the dissipation of accumulated body heat. Also, the work/rest values are cyclic and may be repeated for as many times as necessary to complete a task. The use of the data in Table 15 is somewhat limited, however, in that there are no data given for temperatures below 21°C (70°F). For a detailed discussion of the MOPP system, its use and implementation, the reader is referred to FM 21-40, Chapter 5.

\* Revised MOPP tables are reportedly being prepared, but are not available at this time.

TABLE 2 - Performance Degradation Data for Air Defense Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                     | MAJOR FUNCTION                                          | DESCRIPTION                      | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |              |
|----------------------------------|---------------------------------------------------------|----------------------------------|----------|----------------------------------------|--------------------------------------------|--------------|--------------|
|                                  |                                                         |                                  |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |              |
|                                  |                                                         |                                  |          |                                        | 020°F (-7°C)                               | 050°F (10°C) | 085°F (29°C) |
| HIMAD Bn HQ (1)<br>(Ops Con Cen) | Displacement, 12-15 trucks                              | Preparation for move (2)         | Heavy    | 45 min                                 | 90 min                                     | 135 min      | 170 min      |
|                                  | Emplacement at maximum cable length                     | Checkout and alignment           | Heavy    | 30 min (2)                             | 60 min                                     | 90 min       | 120 min      |
|                                  | Displacement, 15-20 van/trucks, missile components only | Preparation for move             | Heavy    | 60 min                                 | 120 min                                    | 180 min      | 360 min      |
|                                  | Emplacement                                             | Check out missile test equipment | Moderate | 30 min (3)                             | 30 min                                     | 30 min       | 90 min       |
| All others (5)                   | Displacement                                            | Deliberate                       | Heavy    | 30 min                                 | 60 min                                     | 90 min       | 180 min      |
|                                  | Emplacement                                             |                                  | Moderate | 30 min                                 | 30 min                                     | 30 min       | 90 min       |
|                                  | Displacement (7)                                        | Missile platoons                 | Heavy    | 30 min                                 | 60 min                                     | 90 min       | 180 min      |
|                                  | Emplacement                                             | Support platoons                 | Heavy    | 45 min                                 | 90 min                                     | 135 min      | 270 min      |
| SHORAD (6) Bn HQ                 | Emplacement                                             | Support platoon                  | Heavy    | 60 min                                 | 120 min                                    | 180 min      | 360 min      |
|                                  | Emplacement                                             | Missile platoons                 | Heavy    | 60 min (3)                             | 120 min                                    | 180 min      | 360 min      |
|                                  | Displacement, only 1 platoon                            | Support platoon                  | Heavy    | 30 min                                 | 60 min                                     | 90 min       | 180 min      |
|                                  | Emplacement, only 1 platoon                             | Support platoon                  | Heavy    | 30 min                                 | 60 min                                     | 90 min       | 180 min      |
| HIMAD Battery (8)                | Displacement                                            | Platoon (10)                     | Heavy    | 15 min                                 | 30 min                                     | 45 min       | 90 min       |
|                                  | Emplacement                                             | Support element                  | Heavy    | 30 min                                 | 60 min                                     | 90 min       | 180 min      |
|                                  | Displacement                                            |                                  |          |                                        |                                            |              |              |
|                                  | Emplacement                                             |                                  |          |                                        |                                            |              |              |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 2 - (continued)- Performance Degradation Data for Air Defense Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT       | MAJOR FUNCTION | DESCRIPTION     | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |             |             |
|--------------------|----------------|-----------------|----------|----------------------------------------|-------------------------------------------|-------------|-------------|
|                    |                |                 |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |             |             |
|                    |                |                 |          |                                        | @20°F(-7°C)                               | @50°F(10°C) | @85°F(29°C) |
| SHORAD Battery (9) | Emplacement    | Platoon         | Heavy    | 20 min                                 | 40 min                                    | 60 min      | 120 min     |
|                    |                |                 |          |                                        |                                           |             |             |
| MANPAD (11)        | Displacement   | Support element | Heavy    | 30 min                                 | 60 min                                    | 90 min      | 180 min     |
|                    | Emplacement    | By team (12)    | Moderate | 15 min                                 | 15 min                                    | 15 min      | 45 min      |
| FAAR (13)          | Emplacement    | By team         | Moderate | 15 min                                 | 15 min                                    | 15 min      | 45 min      |
|                    | Displacement   |                 | Heavy    | 15 min                                 | 30 min                                    | 45 min      | 90 min      |
|                    | Emplacement    |                 | Heavy    | 15 min (14)                            | 30 min                                    | 45 min      | 90 min      |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

- (1) HAWK Bn. Includes computer/control (C/c) system W/generators, radars W/generators, and commo vans W/generators.
- (2) Moves for strategic purposes average 30 km; moves for survivability average 1-2 km.
- (3) Assumes that all equipment is operating. Problems requiring trouble shooting and/or repair would require additional time of 30 min to 2 hours.
- (4) Unit contains maintenance and repair parts; is attached to HIMAD En Hq.
- (5) Includes motor pool, supply room, mess facility, medical support, property book section, etc.
- (6) SHORAD Bns have either Chaparral or Vulcan systems.
- (7) Does not have C/c system, or a direct support platoon.
- (8) Includes 3 Fire Platoons W/all missile equipment and all support (motor pool, supply room, HQ, mess facility, tents, etc.).
- (9) SHORAD batteries deployed by platoons.
- (10) Platoon has 4 vehicles, either guns or SP missile launchers, self-contained.
- (11) Man Portable Air Defense (MANPAD). Employs REDEYE system, being replaced by STINGER system.
- (12) Team consists of 2 men with jeep and trailer.
- (13) Forward Area Alerting Radar (FAAR). Deployed individually, on a vehicle.
- (14) Assumes equipment is working. If not working, assistance must be requested. It could take up to an hour, or more, to obtain help.

NOTES: (a) HIMAD systems include the NIKE HERCULES. Multiply times by 2 or 3 for NIKE HERCULES system.

(b) All times given for HIMAD systems are for the HAWK system.

(c) SHORAD times apply to both CHAPARRAL and VULCAN systems.

TABLE 3 - Performance Degradation Data for Armor Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                       | MAJOR FUNCTION                             | DESCRIPTION                         | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |              |              |
|----------------------------------------------------|--------------------------------------------|-------------------------------------|----------|----------------------------------------|-------------------------------------------|--------------|--------------|
|                                                    |                                            |                                     |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |              |              |
|                                                    |                                            |                                     |          |                                        | 020°F (-7°C)                              | 050°F (10°C) | 085°F (29°C) |
| Battalion, HQ<br>(Located ~ 8 km<br>back of FEBA)  | Displacement of Bn HQ                      | Hasty (ready to move) 1/            | Heavy    | 15 min                                 | 30 min                                    | 45 min       | 90 min       |
|                                                    |                                            | Deliberate (ready to move)          | Heavy    | 30 min                                 | 60 min                                    | 90 min       | 180 min      |
|                                                    | Emplacement of BN CP                       | Hasty, for radio communication only | Heavy    | 15 min                                 | 30 min                                    | 45 min       | 90 min       |
|                                                    |                                            | Deliberate, completely operational  | Heavy    | 2 hrs                                  | 4 hrs                                     | 6 hrs        | 12 hrs       |
|                                                    | Lay Wire (wire section, 5 men)             | Minimum amount of wire required     | Heavy    | 1 hr                                   | 2 hrs                                     | 3 hrs        | 6 hrs        |
| Brigade Trains,<br>located ~ 20 km<br>back of FEBA | Antenna emplacement, 3-4 men (H577A1 crew) | RC-292 antenna                      | Heavy    | 20 min                                 | 40 min                                    | 60 min       | 120 min      |
|                                                    | Maintenance                                | Get ready to move                   | Heavy    | 2 hrs                                  | 4 hrs                                     | 6 hrs        | 12 hrs       |
|                                                    |                                            | Get operational once reach new site | Heavy    | 2 hrs                                  | 4 hrs                                     | 6 hrs        | 12 hrs       |
|                                                    |                                            | To be fully operational at new site | Heavy    | 4 hrs                                  | 8 hrs                                     | 12 hrs       | 24 hrs       |
|                                                    | Battalion Aid Station (BAS)                | To get ready to move                | Heavy    | 1 hr                                   | 2 hrs                                     | 3 hrs        | 6 hrs        |
| Company, 3 Platoons, 15 Tanks                      |                                            | To set up in new position           | Heavy    | 1 hr                                   | 2 hrs                                     | 3 hrs        | 6 hrs        |
|                                                    | Maintenance                                | Organizational, per move            | Moderate | 1 hr                                   | 1 hr                                      | 1 hr         | 3 hrs        |
|                                                    |                                            | Organizational, per road march      | Moderate | 1 hr                                   | 1 hr                                      | 1 hr         | 3 hrs        |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 3 - (continued) - Performance Degradation Data for Armor Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                          | MAJOR FUNCTION               | DESCRIPTION                                           | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                                            |                                            |
|-------------------------------------------------------|------------------------------|-------------------------------------------------------|----------|----------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
|                                                       |                              |                                                       |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |
| COMPANY, 3 Platoons, 15 Tanks<br><br>Platoon, 5 Tanks | Position Selection           | By commander, per move                                | Moderate | 1 hr                                   | 020°F (-7°C)                               | 050°F (10°C)                               | 085°F (29°C)                               |
|                                                       | Command post move            | Per move                                              | Moderate | 15 min                                 | 15 min                                     | 15 min                                     | 45 min                                     |
|                                                       | Displacement, ~ 5km distance | Hasty (ready to move)                                 | Moderate | < 1 min                                | < 1 min                                    | < 1 min                                    | ~ 5 min                                    |
|                                                       |                              | Across desert @ ~ 20km/hr                             | Light    | 15 min                                 | 15 min                                     | 15 min                                     | 15 min                                     |
|                                                       |                              | Across rough terrain (rocks, gullies) @ ~ 10-15 km/hr | Light    | 20 min                                 | 20 min                                     | 20 min                                     | 20 min                                     |
|                                                       |                              | Across terrain where no trail exists @ ~ 2-3 km/hr    | Light    | 2 hrs                                  | 2 hrs                                      | 2 hrs                                      | 3.5 hrs                                    |
|                                                       |                              | Advancing with infantry @ 2-3 km/hr                   | Light    | 2 hrs                                  | 2 hrs                                      | 2 hrs                                      | 3.5 hrs                                    |
|                                                       | Maintenance                  | Replace tank engine (4 men, pull and reinstall)       | Heavy    |                                        |                                            |                                            |                                            |
|                                                       |                              | For XM1                                               |          | 2 hrs                                  | 4 hrs                                      | 6 hrs                                      | 12 hrs                                     |
|                                                       |                              | For M60                                               |          | 4 hrs                                  | 8 hrs                                      | 12 hrs                                     | 24 hrs                                     |
|                                                       |                              | Replace track (done in place by crew)                 | Heavy    |                                        |                                            |                                            |                                            |
|                                                       |                              | For thrown track                                      |          | 1 hr                                   | 2 hrs                                      | 3 hrs                                      | 6 hrs                                      |
| Platoon                                               |                              | For damaged track                                     |          | 2 hrs                                  | 4 hrs                                      | 6 hrs                                      | 12 hrs                                     |
|                                                       |                              | Clean air filters. <sup>2/</sup> For XM1              | Heavy    | 1 hr                                   | 2 hrs                                      | 3 hrs                                      | 6 hrs                                      |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 3 - (continued) - Performance Degradation Data for Armor Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                      | MAJOR FUNCTION                    | DESCRIPTION                                          | WORKLOAD             | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |                    |                    |
|---------------------------------------------------|-----------------------------------|------------------------------------------------------|----------------------|----------------------------------------|-------------------------------------------|--------------------|--------------------|
|                                                   |                                   |                                                      |                      | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |                    |                    |
|                                                   |                                   |                                                      |                      |                                        | 020°F (-7°C)                              | 050°F (10°C)       | 085°F (29°C)       |
| Platoon                                           | Maintenance (cont)                | Daily, routine                                       | Light/<br>Moderate   | 1 hr/move                              | 1 hr/move                                 | 1 hr/move          | 1.5 hr/move        |
|                                                   |                                   | After road march                                     | Light/<br>Moderate   | 1 hr                                   | 1 hr                                      | 1 hr               | 1.5 hr             |
|                                                   | Recovery <sup>3/</sup>            | Time for notification to travel to site              | Light                | 30 min                                 | 30 min                                    | 30 min             | 30 min             |
|                                                   |                                   | Time to hook up                                      | Moderate             | 15 min                                 | 15 min                                    | 15 min             | 45 min             |
| Platoon, Transportation                           | Ammunition resupply               | Full turn around <sup>4/</sup>                       | Light/Heavy          | 4 hrs                                  | 6 hrs                                     | 8 hrs              | 12 hrs             |
|                                                   |                                   | From Brigade trains to tanks                         | Light/Heavy          | 2 hrs                                  | 3 hrs                                     | 4 hrs              | 6 hrs              |
|                                                   | Refuel                            | For 5 tanks:<br>M60 (250 gallon)<br>XM1 (375 gallon) | Moderate<br>Moderate | 1.5 hrs<br>2.5 hrs                     | 1.5 hrs<br>2.5 hrs                        | 1.5 hrs<br>2.5 hrs | 2.5 hrs<br>4.5 hrs |
|                                                   | Refill fuel tankers <sup>5/</sup> | Turn around time (top off in trains area)            | Moderate             | 2 hrs                                  | 2 hrs                                     | 2 hrs              | 3 hrs              |
| Troop, Ground CAV<br>(Company Size) <sup>6/</sup> | Resupply tank ammunition, for M60 | Load 30 cannon rds                                   | Heavy                | 30 min                                 | 60 min                                    | 90 min             | 180 min            |
|                                                   |                                   | Load .50-cal, 7.62mm, smoke grenades, as required    | Heavy                | 15 min                                 | 30 min                                    | 45 min             | 90 min             |
|                                                   | Fire mission, 4.2-inch mortar     | Preplanned (preset)                                  | Heavy                | 10 rds/min                             | 8 rds/min                                 | 6 rds/min          | 4 rds/min          |
|                                                   |                                   | Not preplanned, usually sustained                    | Heavy                | 6 rds/min                              | 5 rds/min                                 | 4 rds/min          | 2 rds/min          |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 3 - (continued) - Performance Degradation Data for Armor Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                                                                                                       | MAJOR FUNCTION                                                                                  | DESCRIPTION                       | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |
|------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|-----------------------------------|----------|----------------------------------------|--------------------------------------------|--------------|
|                                                                                                                                    |                                                                                                 |                                   |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |
|                                                                                                                                    |                                                                                                 |                                   |          |                                        | @20°F (-7°C)                               | @50°F (10°C) |
| Troop Ground CAV<br>(Company Size)<br>Platoon, Scout (Recon)<br>(9 M113's)                                                         | Preparation for fire mission                                                                    | Unpack and set charges (PD fuzes) | Heavy    | 1.5min/rd                              | 2mins/rd                                   | 4mins/rd     |
|                                                                                                                                    | Site occupation                                                                                 | Hasty                             | Heavy    | 15 min                                 | 20 min                                     | 90 min       |
|                                                                                                                                    |                                                                                                 | Deliberate                        | Heavy    | 20 min                                 | 40 min                                     | 120 min      |
|                                                                                                                                    | Site displacement                                                                               | Hasty                             | Heavy    | 5 min                                  | 10 min                                     | 10 min       |
|                                                                                                                                    |                                                                                                 | Deliberate                        | Heavy    | 30 min                                 | 60 min                                     | 180 min      |
|                                                                                                                                    | Recon area 5km x 5km                                                                            | To refuel M113                    | Moderate | 20 min                                 | 20 min                                     | 35 min       |
|                                                                                                                                    |                                                                                                 | To rearm M113 (machine gun)       | Heavy    | 15 min                                 | 30 min                                     | 45 min       |
|                                                                                                                                    |                                                                                                 | To displace (in dis-mounted mode) | Moderate | 5 min(max)                             | 5 min                                      | 10 min       |
|                                                                                                                                    | 1/ All moves, unless otherwise stated, are made at 30km/hr.                                     |                                   |          |                                        |                                            |              |
|                                                                                                                                    | 2/ Filters removed, shaken, and replaced. Done after approximately every 10 hours of operation. |                                   |          |                                        |                                            |              |
| 3/ Rate of travel during recovery: tank w/o track, 8 km/hr; tank w/track, 20 km/hr.                                                |                                                                                                 |                                   |          |                                        |                                            |              |
| 4/ Loaded truck going from Brigade Trains area to tanks, back to ASP, reload, back to Brigade trains.                              |                                                                                                 |                                   |          |                                        |                                            |              |
| 5/ Tankers going from Brigade Trains area to tanks, back to PDL supply, reload, back to Brigade Trains.                            |                                                                                                 |                                   |          |                                        |                                            |              |
| 6/ Primary function is reconnaissance, but strong enough to fight.                                                                 |                                                                                                 |                                   |          |                                        |                                            |              |
| 7/ Perform route recon, early warning, flank security, rear area security. Range from 2 km forward of FEBA to 5-10KM back of FEBA. |                                                                                                 |                                   |          |                                        |                                            |              |

1/ All moves, unless otherwise stated, are made at 30km/hr.

2/ Filters removed, shaken, and replaced. Done after approximately every 10 hours of operation.

3/ Rate of travel during recovery: tank w/o track, 8 km/hr; tank w/track, 20 km/hr.

4/ Loaded truck going from Brigade Trains area to tanks, back to ASP, reload, back to Brigade trains.

5/ Tankers going from Brigade Trains area to tanks, back to POL supply, reload, back to Brigade Trains.

6/ Primary function is reconnaissance, but strong enough to fight.

7/ Perform route recon, early warning, flank security, rear area security. Range from 2 km forward of FEBA to 5-10km back of FEBA.

<sup>+</sup>Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 4 - Performance Degradation Data for Artillery Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT     | MAJOR FUNCTION                        | DESCRIPTION                                              | WORKLOAD         | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                                            |                                            |
|------------------|---------------------------------------|----------------------------------------------------------|------------------|----------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
|                  |                                       |                                                          |                  | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |
| Battalion (BQS)  | Site Occupation                       | Emergency <sup>2/</sup> (For FDC only)                   | Heavy            | ~ 20 min                               | 40 min                                     | 60 min                                     | 120 min                                    |
|                  |                                       | Deliberate <sup>3/</sup>                                 | Heavy            | ~ 20 min                               | 40 min                                     | 60 min                                     | 120 min                                    |
|                  | Site Displacement                     | Emergency <sup>4/</sup> (For FDC only)                   | Heavy            | 6 min                                  | 12 min                                     | 12 min                                     | 36 min                                     |
|                  |                                       | Deliberate <sup>5/</sup>                                 | Heavy            | 30 min                                 | 60 min                                     | 90 min                                     | 180 min                                    |
|                  | Fire Mission <sup>7/</sup>            | 6 Howitzers/5 volleys (1 in Effect)                      | Heavy            | 8.5 min                                | 17 min                                     | 25.5 min                                   | 51 min                                     |
|                  |                                       | Emergency <sup>2/</sup>                                  | Heavy            | 15 min                                 | 30 min                                     | 45 min                                     | 90 min                                     |
|                  | Site Occupation                       | Deliberate <sup>3/</sup>                                 | Heavy            | 20 min                                 | 40 min                                     | 60 min                                     | 120 min                                    |
|                  |                                       | Emergency <sup>4/</sup>                                  | Heavy            | 3 min                                  | 6 min                                      | 9 min                                      | 18 min                                     |
|                  | Site Displacement                     | Deliberate <sup>5/</sup>                                 | Heavy            | 30 min                                 | 60 min                                     | 90 min                                     | 180 min                                    |
|                  |                                       | 30 km/hr                                                 | Light            | (Max) 12 hrs day                       | 12 hrs day                                 | 12 hrs day                                 | 12 hrs day                                 |
| 155 (SP) Battery | Road March                            | Deliberate                                               | Moderate         | ~ 1 hr                                 | 1 hr                                       | 1 hr                                       | 1.5 hr                                     |
|                  |                                       | Organization                                             | Variable         | N/A                                    | N/A                                        | N/A                                        | N/A                                        |
|                  | Reconnaissance and Position Selection | Turn around time for 10km trip 6/-5 ton truck/155mm ammo | Moderate - Heavy | 4 hrs                                  | 4-6 hrs                                    | 4-8 hrs                                    | 6-12 hrs                                   |
|                  |                                       | Emergency <sup>2/</sup>                                  | Heavy            | 2 min                                  | 4 min                                      | 6 min                                      | 12 min                                     |
|                  | Maintenance                           | Deliberate <sup>3/</sup>                                 | Heavy            | 5 min                                  | 10 min                                     | 15 min                                     | 30 min                                     |
|                  |                                       | Emergency <sup>4/</sup>                                  | Heavy            | 3 min                                  | 6 min                                      | 9 min                                      | 18 min                                     |
|                  | Ammo Supply                           | Deliberate <sup>5/</sup>                                 | Heavy            | 30 min                                 | 60 min                                     | 90 min                                     | 180 min                                    |
|                  |                                       | Emergency <sup>2/</sup>                                  | Heavy            | 2 min                                  | 4 min                                      | 6 min                                      | 12 min                                     |
|                  | Howitzer Section                      | Deliberate <sup>3/</sup>                                 | Heavy            | 5 min                                  | 10 min                                     | 15 min                                     | 30 min                                     |
|                  |                                       | Emergency <sup>4/</sup>                                  | Heavy            | 3 min                                  | 6 min                                      | 9 min                                      | 18 min                                     |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).  
NOTE: Footnotes on following page.

TABLE 4 (continued) - Performance Degradation Data for Artillery Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                | MAJOR FUNCTION        | DESCRIPTION                                 | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |             |
|-----------------------------|-----------------------|---------------------------------------------|----------|----------------------------------------|--------------------------------------------|-------------|
|                             |                       |                                             |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |             |
|                             |                       |                                             |          |                                        | 82°F (-7°C)                                | 85°F (29°C) |
| Fire Direction Section      | Fire Mission          | 1 round/min (6 rds)                         | Moderate | 6 min                                  | 6 min                                      | 9 min       |
|                             | Service Ammo          | 1 round/min (6 rds)                         | Heavy    | 6 min                                  | 12 min                                     | 36 min      |
|                             | Site Occupation       | Emergency                                   | Heavy    | 20 min                                 | 40 min                                     | 120 min     |
|                             | Site Displacement     | Deliberate                                  | Heavy    | 20 min                                 | 40 min                                     | 120 min     |
|                             | Compute Fire Mission  | Emergency                                   | Heavy    | 3 min                                  | 6 min                                      | 18 min      |
| Forward Support Team (FIST) | Target Identification | Will vary by type                           | Light    | Variable                               | Variable                                   | Variable    |
|                             |                       | Time from identification and call for fire. | Light    | 1 min                                  | 1 min                                      | 1 min       |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

- 1/ Bn HQ's are usually but not always within 3-5 km of all batteries.
- 2/ EMERGENCY SITE OCCUPATION is a physical move of about 500 meters performed under emergency conditions. Times given refer to the time elapsed between the moment the lead vehicle has entered the new site until the unit is able to commence operations.
- 3/ DELIBERATE SITE OCCUPATION is a physical move of about 7km performed under tactical conditions. Times given refer to the time elapsed between the moment the lead vehicle has entered the new site until the unit is able to commence operations.
- 4/ EMERGENCY SITE DISPLACEMENT is a physical move of about 500 meters performed under emergency conditions. Times given refer to the time elapsed between the moment the order to move is given until the first vehicle has entered the new site and include movement time.
- 5/ DELIBERATE SITE DISPLACEMENT is a physical move of about 7km performed under tactical conditions. Times given refer to the time elapsed between the moment the order to move is given until the first vehicle has entered the new site and include movement time.
- 6/ From division ASP to firing battery and return. Includes loading of ammunition.
- 7/ Time for the fire mission refers to the time elapsed between the moment the battery receives the FM until the rounds have been fired. Does not include time of flight.

Table 5 - Performance Degradation Data for Aviation Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                            | MAJOR FUNCTION                             | DESCRIPTION                                                                              | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |                              |
|-----------------------------------------|--------------------------------------------|------------------------------------------------------------------------------------------|----------|----------------------------------------|-------------------------------------------|------------------------------|
|                                         |                                            |                                                                                          |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |                              |
|                                         |                                            |                                                                                          |          | 020°F (-7°C)                           | 050°F (10°C)                              | 085°F (29°C)                 |
| Combat Aviation Battalion <sup>1/</sup> | Site Location and Relocation <sup>2/</sup> | Breakdown to move ~ 25km (from time order given to move till first vehicle moves)        | Heavy    | 3 hrs                                  | 6 hrs                                     | 18 hrs                       |
|                                         |                                            | Set-up upon reaching new position (time from arrival of first vehicle until operational) | Heavy    | 2 hrs                                  | 4 hrs                                     | 12 hrs                       |
|                                         | Road March                                 | 30km/hr                                                                                  | Heavy    | 12 hrs max                             | 12 hrs max                                | 12 hrs max                   |
|                                         | Maintenance, Scheduled                     | Daily (if aircraft flew day before)                                                      | Moderate | 1 hr/air - craft(ac)                   | 1 hr/ac                                   | 3 hrs/ac                     |
|                                         |                                            | Every 25 hrs of flying time <sup>3/</sup>                                                | Moderate | ~ 3 hrs/ac                             | ~ 3 hrs/ac                                | ~ 9 hrs/ac                   |
|                                         |                                            | Every 100 hrs of flying time <sup>3/</sup>                                               | Moderate | ~72 hrs (avg)/ac <sup>4/</sup>         | ~72 hrs/ac                                | ~216 hrs/ac                  |
|                                         |                                            | For UH-60, daily                                                                         | Moderate | 2 hrs/ac                               | 2 hrs/ac                                  | 6 hrs/ac                     |
|                                         |                                            | For UH-60, after 50 hrs flying time                                                      | Moderate | 6 hrs/ac                               | 6 hrs/ac                                  | 18 hrs/ac                    |
|                                         |                                            | For UH-60, after 300 hrs flying time                                                     | Moderate | 144 hrs/ac                             | 144 hrs/ac                                | 432 hrs/ac                   |
|                                         | Maintenance, Unscheduled                   | Depending upon number of days elapsed & hrs flown in combat                              | Moderate | Daily hrs + scheduled hrs x2           | Daily hrs + scheduled hrs x2              | Daily hrs + scheduled hrs x3 |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

Table 5 (continued) - Performance Degradation Data for Aviation Units in a Chemical Warfare (Ch.) Environment.

| TYPE OF UNIT | MAJOR FUNCTION                           | DESCRIPTION                                                                                                   | WORKLOAD          | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                                            |                                            |
|--------------|------------------------------------------|---------------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
|              |                                          |                                                                                                               |                   | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |
|              | Spare Parts Acquisition                  | From an Aviation Maintenance Support Company located about 10 km away; via motor vehicle (~20 km roundtrip)   | Light             | 3 hrs                                  | 3 hrs                                      | 3 hrs                                      | 5.25 hrs                                   |
|              |                                          | From Corps Support Command (COSCOM) located about 50 km away; via aircraft (~100 km roundtrip). <sup>5/</sup> | light             | 1.5 hrs                                | 1.5 hrs                                    | 1.5 hrs                                    | 2.0 hrs                                    |
|              | Refue:<br><del>Rearm</del> <sup>7/</sup> | Hot <sup>5/</sup><br>Cold                                                                                     | Moderate<br>Heavy | 10 min<br>30 min                       | 10 min<br>60 min                           | 10 min<br>90 min                           | 20 min<br>180 min                          |
|              | Briefing                                 | For combat assault<br>For parts run                                                                           | Light<br>Light    | 1 hr<br>10 min                         | 1 hr<br>10 min                             | 1 hr<br>10 min                             | 1.25 hr<br>12 min                          |
|              | Debriefing                               | For recon mission<br>For parts run                                                                            | Light<br>Light    | 1 hr<br>0                              | 1 hr<br>0                                  | 1 hr<br>0                                  | 1.25 hr<br>0                               |
|              | Mission planning                         | For combat assault.<br>3 people                                                                               | Light             | 4-5 hrs                                | 4-5 hrs                                    | 4-5 hrs                                    | 6 hrs                                      |
|              | Reconnaissance <sup>8/</sup>             | Visual: 25km to area (from Bn); area 20 x 20 km                                                               | Moderate          | Area 20 km x 20 km                     | Area 10 km x 10 km (day)                   | Area 10 km x 10 km (day)                   | Area 10 km x 10 km (day)                   |
|              | Target Acquisition <sup>9/</sup>         | Scout-provides Azimuth and range                                                                              | Moderate          | 20 sec                                 | 25 sec                                     | 25 sec                                     | 25 sec                                     |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

Table 5 (continued) - Performance Degradation Data for Aviation Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT | MAJOR FUNCTION      | DESCRIPTION                                                                                                                                                                  | WORKLOAD                              | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                                      |                                      |
|--------------|---------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------------------------------------|--------------------------------------------|--------------------------------------|--------------------------------------|
|              |                     |                                                                                                                                                                              |                                       | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |                                      |                                      |
|              |                     |                                                                                                                                                                              |                                       |                                        | @20°F (-7°C)                               | @50°F (10°C)                         | @85°F (29°C)                         |
|              | Target Acquisition  | Gunship - "pop-up," and fire<br>Weapons: HELLFIRE (fire & forget) 5000-6000m<br>TOW @ 3750m<br>40mm @ 1000m<br>2.75-in rocket - fire & forget<br>20mm @ 2000m<br>Turn around | Moderate<br>0<br>15 sec<br>5 sec<br>0 | 10 sec<br>0<br>20 sec<br>10 sec<br>0   | 15 sec<br>0<br>20 sec<br>10 sec<br>0       | 15 sec<br>0<br>20 sec<br>10 sec<br>0 | 15 sec<br>0<br>20 sec<br>10 sec<br>0 |
|              | Missions: Resupply  |                                                                                                                                                                              | Medium                                | Variable                               | Not inhibited by CW                        | Not inhibited by CW                  | Not inhibited by CW                  |
|              | Command and Control |                                                                                                                                                                              | Medium                                | Variable                               | Not inhibited by CW                        | Not inhibited by CW                  | Not inhibited by CW                  |
|              | Medical Evacuation  |                                                                                                                                                                              | Medium                                | Variable                               | Not inhibited by CW                        | Not inhibited by CW                  | Not inhibited by CW                  |
|              | Airlift             |                                                                                                                                                                              | Medium                                | Variable                               | 1.2 x expected time                        | 1.2 x expected time                  | 1.2 x expected time                  |
|              |                     |                                                                                                                                                                              |                                       |                                        |                                            |                                      |                                      |
|              |                     |                                                                                                                                                                              |                                       |                                        |                                            |                                      |                                      |
|              |                     |                                                                                                                                                                              |                                       |                                        |                                            |                                      |                                      |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

- 1/ Unit operates with OH-58, UH-1, and AH-1S aircraft. Unit will also have UH-60 and EH-1H aircraft which are treated separately with respect to maintenance.
- 2/ Multiply times by 1.5 for night operations.
- 3/ For UH-1, OH-58, and AH-1S.
- 4/ Total down time of 72 hours with more than one mechanic working.
- 5/ Generally an emergency request with prior notification.
- 6/ Engine running.
- 7/ 40mm - 30min; 2.75-In - 15 min; TOWs (8 ea) - 30 min on AH-1S; 20mm - 15 min
- 8/ Recon done by 2 each OH-58 with 2.5 hours of fuel, 2 hours of which is mission time including to and from the area as well as the recon maneuvers over the designated area. Recon conditions assumed: nap of the earth to recon area, at appropriate altitude over the area, at an air speed permitted by the terrain, return with 30 minutes of fuel remaining.
- 9/ Scout (OH-58) / Gunship (AH-1S) team operating together. Scout acquires target, directs gunship; in azimuth and range.

TABLE 6 - PERFORMANCE DEGRADATION DATA FOR CHEMICAL UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT

| TYPE OF UNIT                 | MAJOR FUNCTION                           | DESCRIPTION    | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS                      |                                            |                                            |
|------------------------------|------------------------------------------|----------------|----------|-------------------------------------------------------------|--------------------------------------------|--------------------------------------------|
|                              |                                          |                |          | W/O PROTECTIVE CLOTHING*                                    | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |
| HBC Defense Company          | Respond to Receipt of Warning Order      | Planning       | Light    |                                                             | 020°F (-7°C)                               | 050°F (10°C)                               |
|                              | Prepare the Operating Area for Occupancy | Prepare        | Moderate |                                                             |                                            |                                            |
|                              | Move the Company to the Operating Area   | Movement       | Moderate | NOTE: At the time of publication no data had been received. |                                            |                                            |
|                              | Establish Unit Defense                   | Prepare        | Moderate |                                                             |                                            |                                            |
| HBC Defense Company, Platoon | Prepare for Movement                     | Preparation    | Moderate |                                                             |                                            |                                            |
|                              | Platoon Moves to Bde HQ                  | Movement       | Moderate |                                                             |                                            |                                            |
|                              | Position Equipment and Materiel          | Prepare        | Heavy    |                                                             |                                            |                                            |
|                              | Camouflage Equipment                     | Prepare        | Heavy    |                                                             |                                            |                                            |
|                              | Maintain Equipment                       | Reconstitution | Moderate |                                                             |                                            |                                            |
|                              | Request Operating Supplies               | Reconstitution | Light    |                                                             |                                            |                                            |
|                              | Prepare for Operations                   | Preparation    | Moderate |                                                             |                                            |                                            |
|                              | Coordinate/Liaison with Control HQ       | Planning       | Light    |                                                             |                                            |                                            |
|                              | Establish and Maintain Radio Commo       | Prepare        | Moderate |                                                             |                                            |                                            |
|                              |                                          |                |          |                                                             |                                            |                                            |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 6 (continued) - PERFORMANCE DEGRADATION DATA FOR CHEMICAL UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT

| TYPE OF UNIT                             | MAJOR FUNCTION                            | DESCRIPTION         | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                                        |
|------------------------------------------|-------------------------------------------|---------------------|----------|----------------------------------------|--------------------------------------------|----------------------------------------|
|                                          |                                           |                     |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |                                        |
| NBC Defense Company, Platoon (continued) | Establish and Maintain Wire Commo         | Prepare             | Moderate | 020 <sup>0</sup> F (-7 <sup>0</sup> C) | 050 <sup>0</sup> F (10 <sup>0</sup> C)     | 085 <sup>0</sup> F (29 <sup>0</sup> C) |
|                                          | Site Platoon HQ.                          | Prepare             | Heavy    |                                        |                                            |                                        |
|                                          | Control Deployed Squads                   | Recon/Decon         | Light    |                                        |                                            |                                        |
|                                          | Coordinate Resupply for Recon             | Prepare             | Light    |                                        |                                            |                                        |
|                                          | Coordinate Resupply for Decon             | Prepare             | Light    |                                        |                                            |                                        |
| NBC Defense Company, Recon Squad         | Plan and Prepare a Nuclear Reconnaissance | Planning            | Light    |                                        |                                            |                                        |
|                                          | Conduct a Nuclear Reconnaissance          | Recon               | Heavy    |                                        |                                            |                                        |
|                                          | Return from Mission                       | Reconstitution      | Moderate |                                        |                                            |                                        |
|                                          | Plan and Prepare for Aerial Survey        | Planning            | Light    |                                        |                                            |                                        |
|                                          | Conduct Aerial Survey                     | Recon               | Heavy    |                                        |                                            |                                        |
|                                          | Establish AGCF                            | Calculate Dose Rate | Heavy    |                                        |                                            |                                        |
|                                          | Return to Control HQ                      | Reconstitution      | Moderate |                                        |                                            |                                        |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 6 (continued) - PERFORMANCE DEGRADATION DATA FOR CHEMICAL UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT

| TYPE OF UNIT                                 | MAJOR FUNCTION                                              | DESCRIPTION    | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |
|----------------------------------------------|-------------------------------------------------------------|----------------|----------|----------------------------------------|--------------------------------------------|--------------|
|                                              |                                                             |                |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |
|                                              |                                                             |                |          |                                        | 020°F (-7°C)                               | 050°F (10°C) |
| M2C Defense Company, Recon Squad (continued) | Plan and Prepare a Chemical Reconnaissance                  | Planning       | Light    |                                        |                                            | 085°F (29°C) |
|                                              | Conduct a Chemical Reconnaissance                           | Recon          | Heavy    |                                        |                                            |              |
|                                              | Return from Mission                                         | Reconstitution | Moderate |                                        |                                            |              |
|                                              | Plan and Prepare for Biological Sampling                    | Planning       | Light    |                                        |                                            |              |
|                                              | Conduct Biological Sampling                                 | Recon          | Heavy    |                                        |                                            |              |
|                                              | Return from Mission                                         | Reconstitution | Light    |                                        |                                            |              |
|                                              | Plan and Prepare for Recon to Locate Appropriate Recon Site | Planning       | Light    |                                        |                                            |              |
|                                              | Conduct Recon for Decon                                     | Recon          | Heavy    |                                        |                                            |              |
|                                              | Return from Mission                                         | Reconstitution | Moderate |                                        |                                            |              |
|                                              | Plan and Prepare for a Recon                                | Planning       | Light    |                                        |                                            |              |
|                                              | Conduct a Recon                                             | Recon          | Heavy    |                                        |                                            |              |
|                                              | Locate the Composing Force                                  | Recon          | Heavy    |                                        |                                            |              |
|                                              | Treat and Evacuate Casualties                               | Medical Aid    | Heavy    |                                        |                                            |              |
|                                              | Return to Assembly Area                                     | Reconstitution | Moderate |                                        |                                            |              |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 5 (continued)- PERFORMANCE DEGRADATION DATA FOR CHEMICAL UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT

| TYPE OF UNIT                          | MAJOR FUNCTION                       | DESCRIPTION                                                               | WORKLOAD   | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |
|---------------------------------------|--------------------------------------|---------------------------------------------------------------------------|------------|----------------------------------------|--------------------------------------------|--------------|
|                                       |                                      |                                                                           |            | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |
| US Defense Company, Recon Squad, Tech | Preparation of Equipment for mission | Prepare individual and patrol equipment and vehicles.                     | Moderate   |                                        | 020°F (-7°C)                               | 085°F (29°C) |
|                                       | Reconnoiter danger areas dismounted  | Danger areas such as bridges, defile, curve in road, road inter-sections. | Very Heavy |                                        |                                            |              |
|                                       | Use radio communication              | Send and receive messages                                                 | Light      |                                        | (1)                                        | (1)          |
|                                       | Survey and mark PDS/EDS Site         | Mark areas for establishing stations on a PDS/EDS site.                   |            |                                        |                                            |              |
|                                       | Use the M34 soil sampling kit        | Use the M34 kit to collect 810 samples, water samples and soil samples.   | Moderate   |                                        |                                            |              |
|                                       | Use the ABC-M2 water testing kit     | Use to collect water sample and check for contamination.                  | Moderate   |                                        |                                            |              |
|                                       | Use the IM-174 radiological meter    | Take readings from stationary position and while traveling or surveying.  | Moderate   |                                        |                                            |              |
|                                       | Decontaminate unit equipment         | Perform complete decontamination of a level I Mech Inf Bn.                | Heavy      | (2)                                    | 37 hrs                                     |              |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 6 (continued)—PERFORMANCE DEGRADATION DATA FOR CHEMICAL UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT

| TYPE OF UNIT                                       | MAJOR FUNCTION                                                  | DESCRIPTION                                                  | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                                            |              |
|----------------------------------------------------|-----------------------------------------------------------------|--------------------------------------------------------------|----------|----------------------------------------|------------------------------------------------------------|--------------|
|                                                    |                                                                 |                                                              |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE)<br>020°F (-2°C) | 085°F (10°C) |
| NBC Defense Company, Recon Squad, Team (continued) | Service the automatic chemical agent alarm.                     | Perform required services after extended operation.          | Moderate | 30 min                                 |                                                            | 085°F (10°C) |
|                                                    | Test for chemical agents using a detector kit.                  | Perform required tests to determine chemical agent presence. | Moderate | 15 min                                 |                                                            |              |
|                                                    | Test water for chemical contamination.                          |                                                              | Moderate | 30 min                                 |                                                            |              |
|                                                    | Collect biological samples.                                     | Perform required actions to collect biological samples.      | Moderate | 15 min                                 |                                                            |              |
|                                                    | Monitor personnel supplies and equipment for radiation hazards. |                                                              | Light    | Dependent                              |                                                            |              |
|                                                    | Conduct NBC reconnaissance.                                     |                                                              |          |                                        |                                                            |              |
|                                                    | Smoke Operations                                                |                                                              | Heavy    | Dependent                              |                                                            |              |
|                                                    | Conduct radiological surveys.                                   |                                                              | Moderate | Dependent                              |                                                            |              |
|                                                    | Perform site reconnaissance for decontamination site.           |                                                              |          | Dependent                              |                                                            |              |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 6 (continued)—PERFORMANCE DEGRADATION DATA FOR CHEMICAL UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT

| TYPE OF UNIT                     | MAJOR FUNCTION                                  | DESCRIPTION    | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                                            |
|----------------------------------|-------------------------------------------------|----------------|----------|----------------------------------------|--------------------------------------------|--------------------------------------------|
|                                  |                                                 |                |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |
| NBC Defense Company, Decon Squad | Plan and Prepare for PDS Establishment          | Planning       | Light    |                                        |                                            | 085°F (29°C)                               |
|                                  | Establish PDS                                   | Prepare        | Heavy    |                                        |                                            |                                            |
|                                  | Conduct Personnel Decon                         | Decon          | Heavy    | (2)                                    |                                            |                                            |
|                                  | Prepare and Submit Operational Status Reports   | Reporting      | Light    |                                        |                                            |                                            |
|                                  | Close PDS and Prepare for Movement              | Reconstitution | Heavy    | (2)                                    |                                            |                                            |
|                                  | Plan and Prepare for Complete Equipment Decon   | Planning       | Light    |                                        |                                            |                                            |
|                                  | Decon Equipment                                 | Decon          | Heavy    | (2)                                    |                                            |                                            |
|                                  | Close EDS and Prepare for Movement              | Reconstitution | Heavy    | (2)                                    |                                            |                                            |
|                                  | Plan and Prepare for Terrain Decon              | Planning       | Light    |                                        |                                            |                                            |
|                                  | Decon the Terrain                               | Decon          | Heavy    | (2)                                    |                                            |                                            |
|                                  | Complete the Operation and Prepare for Movement | Reconstitution | Heavy    | (2)                                    |                                            |                                            |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 6 (continued)—PERFORMANCE DEGRADATION DATA FOR CHEMICAL UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT

| TYPE OF UNIT                                 | MAJOR FUNCTION                             | DESCRIPTION    | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |
|----------------------------------------------|--------------------------------------------|----------------|----------|----------------------------------------|--------------------------------------------|--------------|
|                                              |                                            |                |          | W/G PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |
|                                              |                                            |                |          |                                        | 020°F (-7°C)                               | 050°F (10°C) |
| NBC Defense Company, Decon Squad (continued) | Plan and Prepare for PDS/EDS Establishment | Planning       | Light    |                                        |                                            | 085°F (29°C) |
|                                              | Establish PDS/EDS                          | Prepare        | Heavy    | (2)                                    |                                            |              |
|                                              | Conduct Personnel Decon                    | Decon          | Heavy    | (2)                                    |                                            |              |
|                                              | Decon Equipment                            | Decon          | Heavy    | (2)                                    |                                            |              |
|                                              | Close PDS/EDS and Prepare for Movement     | Reconstitution | Heavy    | (2)                                    |                                            |              |
|                                              | Plan and Prepare for a Hasty Decon         | Planning       | Light    |                                        |                                            |              |
|                                              | Establish a Hasty Decon Point              | Prepare        | Heavy    | (2)                                    |                                            |              |
|                                              | Decon Equipment                            | Decon          | Heavy    | (2)                                    |                                            |              |
|                                              | Close Point and Prepare for Movement       | Reconstitution | Heavy    | (2)                                    |                                            |              |
|                                              |                                            |                |          |                                        |                                            |              |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 6 (continued) - PERFORMANCE DEGRADATION DATA FOR CHEMICAL UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT

| TYPE OF UNIT                                 | MAJOR FUNCTION                                               | DESCRIPTION                                                             | WORKLOAD       | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                                            |                                            |
|----------------------------------------------|--------------------------------------------------------------|-------------------------------------------------------------------------|----------------|----------------------------------------|--------------------------------------------|--------------------------------------------|--------------------------------------------|
|                                              |                                                              |                                                                         |                | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |
| NBC defense Company, Decon Squad (continued) | Perform complete decontamination of personnel                | Process personnel through a PDS (for a Mech. Inf. Co. of 175 personnel) | Moderate       | (2)                                    | 020°F (-7°C)<br>30 min/2 per               | 050°F (10°C)<br>30 min/2 per               | 085°F (29°C)<br>30 min/2 per (3)           |
|                                              | Perform complete decontamination of equipment                | Decon 16 APCs (M113A1s) of a Mech. Inf. Co.                             | Heavy          | (2)                                    | 2hrs/vehicle                               | 2hrs/vehicle                               | 2hrs/vehicle (4)                           |
|                                              | Prepare upper air wind data and detailed fallout predictions | Effective downwind msg fallout prediction                               | Light<br>Light | 45 min<br>20 min                       | (5)<br>(6)                                 |                                            |                                            |
| NBCE/JA/JB                                   |                                                              |                                                                         |                |                                        |                                            |                                            |                                            |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

- (1) Messages must usually be repeated.
- (2) Decontamination operations are not performed w/o protective clothing.
- (3) Same time but station operators must be changed every 15 minutes.
- (4) Same time but station operators must be changed after each vehicle.
- (5) Standard is about 25 minutes.
- (6) Standard is about 15 minutes.

TABLE 7. PERFORMANCE DEGRADATION DATA FOR COMBAT ENGINEER UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT.

| TYPE OF UNIT                                                                 | MAJOR FUNCTION                                                             | DESCRIPTION                                                           | WORKLOAD                   | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                    |
|------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------------|----------------------------|----------------------------------------|--------------------------------------------|--------------------|
|                                                                              |                                                                            |                                                                       |                            | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |                    |
|                                                                              |                                                                            |                                                                       |                            | 020°F (-7°C)                           | 050°F (10°C)                               | 085°F (29°C)       |
| Battalion HQ, S-2<br><br><br><br><br><br><br><br><br><br><br>Line Company 5/ | Reconnaissance                                                             | Route recon, 2 men, avg. 10 km $\frac{1}{2}$                          | Moderate                   | 2 hrs                                  | 2 hrs                                      | 6 hrs              |
|                                                                              | Mess facility (fold-up field kitchen)                                      | Disassemble Assemble (to get operational)                             | Heavy Heavy                | 20 min $\frac{2}{3}$<br>35 min         | 40 min<br>70 min                           | 120 min<br>210 min |
|                                                                              | Displacement, $\frac{3}{3}$ M577A1s                                        | To new position (10-15km distance)                                    | Light-Moderate             | 45 min/ea vehicle                      | 45 min/ea vehicle                          | 75 min/ea vehicle  |
|                                                                              | Load mines (manual)                                                        | Average minefield, 2 5-ton dumptrucks                                 | Heavy                      | 1.5 hrs                                | 3 hrs                                      | 9.0 hrs            |
|                                                                              | Load demolitions (manual)                                                  | For road crater, 2 5-ton dumptrucks                                   | Heavy                      | 30 min                                 | 60 min                                     | 180 min            |
|                                                                              | Secure site                                                                | Organize work area                                                    | Light                      | 15 min                                 | 15 min                                     | 25 min             |
|                                                                              | Reconnaissance                                                             | For obstacle locations, time from start till ready to order materials | Light/Moderate             | 45 min                                 | 45 min                                     | 105 min            |
|                                                                              |                                                                            | For class 50 or more bridge (to handle tank traffic)                  | Light/Moderate             | 3 hrs                                  | 3 hrs                                      | ~7 hrs             |
|                                                                              |                                                                            | For assault bridge (to cross river or ditch)                          | Light/Moderate             | 2 hrs                                  | 2 hrs                                      | 6 hrs              |
|                                                                              | Prepare hull defilade position, per tank per-digging vehicle $\frac{6}{6}$ | For large gully w/o water<br>Dirt berm around tank                    | Light/Moderate<br>Moderate | 30 min<br>30 min                       | 30 min<br>30 min                           | 90 min<br>90 min   |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 7 - (Continued) - PERFORMANCE DEGRADATION DATA FOR COMBAT ENGINEER UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT.

| TYPE OF UNIT | MAJOR FUNCTION                                         | DESCRIPTION                                            | WORKLOAD       | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |                          |             |
|--------------|--------------------------------------------------------|--------------------------------------------------------|----------------|----------------------------------------|-------------------------------------------|--------------------------|-------------|
|              |                                                        |                                                        |                | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |                          |             |
|              |                                                        |                                                        |                |                                        | 020°F(-7°C)                               | 050°F(10°C)              | 085°F(29°C) |
| Line Company | Dig tank ditch, 2 digging vehicles in any combination  | 3.2m Wide x 1.8m deep                                  | Moderate       | 2.5 hrs/100m length                    | 2.5 hrs/100m length                       | 2.5 hrs/100m length      |             |
|              | Minefield emplacement: w/M57 towed mine dispenser      | 300m long x 50m deep <u>1/</u>                         | Moderate       | 1 platoon hr                           | 1 platoon hr                              | 3 platoon hours          |             |
|              | By hand                                                | 100m long x 100m deep <u>1/</u>                        | Heavy          | 4 squad hrs                            | 8 squad hrs                               | 12 squad hrs             |             |
|              | Disable bridges                                        | 4 lane highway                                         | Heavy          | 3 squad hrs                            | 6 squad hrs                               | 9 squad hrs              |             |
|              |                                                        | 2 lane primary road                                    | Heavy          | 2 squad hrs                            | 4 squad hrs                               | 6 squad hrs              |             |
|              | Build abatis (30 trees, 25-35 cm in diam.)             | 40 meters deep w/trees 2 meters apart                  | Heavy          | 2 squad hrs                            | 4 squad hrs                               | 6 squad hrs              |             |
|              | Build road crater, average size (terrain dependent)    | 50m long x 25m wide x 4m deep                          | Heavy          | 2 squad hrs                            | 4 squad hrs                               | 6 squad hrs              |             |
|              | Breach minefield                                       | Hasty(w/bangalore torpedo-footpath wide)               | Heavy          | 2 squad hrs                            | 4 squad hrs                               | 6 squad hrs              |             |
|              |                                                        | Using detector/probe 8-ft wide                         | Heavy          | 1 platoon hr                           | 2 platoon hrs                             | 3 platoon hrs            |             |
|              |                                                        | W/M157 demolition snake, 90m deep, 4-6m wide           | Heavy          | 2 squad hrs                            | 4 squad hrs                               | 6 squad hrs              |             |
| Bridging     | Temporary fording <u>8/</u>                            | Temporary fording <u>8/</u>                            | Heavy          | 1 hr for equipment                     | 2 hrs for equipment                       | 3 hrs for equipment      |             |
|              | Mobile assault bridge: Ideal conditions w/fast current | Mobile assault bridge: Ideal conditions w/fast current | Heavy<br>Heavy | 200m/hr<br>150m/hr                     | 200m/2 hrs<br>150m/2 hrs                  | 200m/3 hrs<br>150m/3 hrs |             |
|              |                                                        |                                                        |                |                                        |                                           | 6 hrs for equipment      |             |
|              |                                                        |                                                        |                |                                        |                                           | 200m/6 hrs<br>150m/6 hrs |             |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 7 - (Continued) - PERFORMANCE DEGRADATION DATA FOR COMBAT ENGINEER UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT

| TYPE OF UNIT | MAJOR FUNCTION | DESCRIPTION                                                          | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                           |
|--------------|----------------|----------------------------------------------------------------------|----------|----------------------------------------|--------------------------------------------|---------------------------|
|              |                |                                                                      |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |                           |
|              |                |                                                                      |          |                                        | @20°F (-7°C)                               | @50°F (10°C) @85°F (29°C) |
| Line Company | Bridging       | Ribbon bridge <sup>9/</sup>                                          | Heavy    | 5 min./bay                             | 10 min./bay                                | 15 min./bay               |
|              |                | Ribbon bridge, 100 foot length under ideal conditions <sup>10/</sup> | Heavy    | 3 hrs                                  | 5 hrs                                      | 9 hrs                     |
|              |                | Bailey bridge, 25 m long, ideal conditions                           | Heavy    | 5.5 hrs<br>(7 hrs in dark)             | 11 hrs                                     | 16.5 hrs                  |

1/ Includes time from start, coordination with requesting unit, doing actual survey, completion of paper work, and return.

2/ Does not include travel time.

3/ Have 3 M577A1s; one always operational, 2 moving.

4/ Operates forward stockage point.

5/ Consists of 3 platoons of 3 squads each. Squads use one M113 (APC) + a 1.5-ton trailer; 8 men.

6/ Requested by armor unit. Performed ahead of time. Dig hole large enough to hide tank.

7/ Density of 0.5 mines/meter of front. Double times if density of 1 mine/meter of front is used.

8/ Knock down banks, grade, add gravel, etc.

9/ Medium girder bridge. Number of bays depends upon width of river. For each 3 bays, add 5 min for bridge erection boat.

10/ 42 people. assume trained troops. Add 50-100% if dark; add 30-50% for bad weather. Add 20% to time if untrained troops.

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 7(a). PERFORMANCE DEGRADATION DATA FOR COMBAT ENGINEER UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT.

| TYPE OF UNIT                      | MAJOR FUNCTION                       | DESCRIPTION                                                | WORKLOAD                | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS  |                                                  |                                                  |                                                  |
|-----------------------------------|--------------------------------------|------------------------------------------------------------|-------------------------|-----------------------------------------|--------------------------------------------------|--------------------------------------------------|--------------------------------------------------|
|                                   |                                      |                                                            |                         | W/O PROTECTIVE CLOTHING*                | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE)       |                                                  |                                                  |
|                                   |                                      |                                                            |                         |                                         | 020°F (-7°C)                                     | 050°F (10°C)                                     | 085°F (29°C)                                     |
| Note: Times are given in FM 5-34. | Mine emplacement, per man            | Anti-tank<br>Anti-personnel, frag<br>Anti-personnel, blast | Heavy<br>Heavy<br>Heavy | 4 mines/hr<br>8 mines/hr<br>16 mines/hr | 4 mines/2 hrs<br>8 mines/2 hrs<br>16 mines/2 hrs | 4 mines/3 hrs<br>8 mines/3 hrs<br>16 mines/3 hrs | 4 mines/6 hrs<br>8 mines/6 hrs<br>16 mines/6 hrs |
|                                   | Shelter, no revetment materials used | Open 1-man foxhole                                         | Heavy                   | 2 hrs                                   | 4 hrs                                            | 6 hrs                                            | 12 hrs                                           |
|                                   |                                      | Open 2-man foxhole                                         | Heavy                   | 3 man hrs.                              | 6 man hrs                                        | 9 man hrs                                        | 18 man hrs                                       |
|                                   |                                      | Open automatic rifle emplacement                           | Heavy                   | 4 man hrs                               | 8 man hrs                                        | 12 man hrs                                       | 24 man hrs                                       |
|                                   |                                      | Open horseshoe type M50 MG emplacement                     | Heavy                   | 4 man hrs                               | 8 man hrs                                        | 12 man hrs                                       | 24 man hrs                                       |
|                                   |                                      | 105-mm howitzer emplacement                                | Heavy                   | 100 man hrs                             | 200 man hrs                                      | 300 man hrs                                      | 600 man hrs                                      |
|                                   |                                      | 155-mm howitzer emplacement                                | Heavy                   | 170 man hrs                             | 340 man hrs                                      | 510 man hrs                                      | 1020 man hrs                                     |
|                                   |                                      |                                                            |                         |                                         |                                                  |                                                  |                                                  |
|                                   |                                      |                                                            |                         |                                         |                                                  |                                                  |                                                  |
|                                   |                                      |                                                            |                         |                                         |                                                  |                                                  |                                                  |
|                                   |                                      |                                                            |                         |                                         |                                                  |                                                  |                                                  |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 8 - Performance Degradation Data for Infantry Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT   | MAJOR FUNCTION                                                   | DESCRIPTION                                           | WORKLOAD         | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |
|----------------|------------------------------------------------------------------|-------------------------------------------------------|------------------|----------------------------------------|--------------------------------------------|--------------|
|                |                                                                  |                                                       |                  | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |
|                |                                                                  |                                                       |                  |                                        | @20°F (-7°C)                               | @50°F (10°C) |
| Squad, 9 man   | Maintenance                                                      | Clean weapon                                          | Light            | 15 min                                 | 20 min                                     | 20 min       |
|                | Position preparation, 2-man                                      | Hasty, minimum protection,                            |                  |                                        |                                            |              |
|                |                                                                  | In sand                                               | Heavy            | 10 min                                 | 20 min                                     | 30 min       |
|                |                                                                  | In clay                                               | Heavy            | 120 min                                | 240 min                                    | 360 min      |
|                |                                                                  | In plowed, loose dirt                                 | Heavy            | 30 min                                 | 60 min                                     | 90 min       |
|                |                                                                  | Deliberate, improved protection,                      |                  |                                        |                                            |              |
|                |                                                                  | In sand                                               | Heavy            | 20 min                                 | 40 min                                     | 60 min       |
|                |                                                                  | In clay                                               | Heavy            | 240 min                                | 480 min                                    | 720 min      |
|                |                                                                  | In plowed, loose dirt                                 | Heavy            | 60 min                                 | 120 min                                    | 180 min      |
|                |                                                                  | 4 km @ 4 km/hr                                        | Heavy            | 60 min                                 | 120 min                                    | 180 min      |
| Maintenance Bn | Road march (normal)                                              | Fast walk, 6 km/hr                                    | Heavy            | 20 min                                 | 40 min                                     | 60 min       |
|                | Assault, 500 meters against moderate opposition                  |                                                       |                  |                                        |                                            |              |
|                | Rest, relief, mess                                               | Protected                                             | Light            | Variable                               | Variable                                   | Variable     |
|                | Refuel four M113's, turn around times, or Bn fuel tankers (1)(2) | 15 km, refuel 4 vehicles, 15 km return, refill tanker | Light - Moderate | 3.5 hrs                                | 3.5 hrs                                    | 3.5 hrs      |
|                | Ammunition resupply, turn around time for Bn trucks (2)(3)       | 15 km, unload, 15 km return, reload truck             | Light - Heavy    | 1.5 hrs                                | 3.0 hrs                                    | 4.5 hrs      |
|                |                                                                  |                                                       |                  |                                        |                                            |              |
|                |                                                                  |                                                       |                  |                                        |                                            |              |
|                |                                                                  |                                                       |                  |                                        |                                            |              |
|                |                                                                  |                                                       |                  |                                        |                                            |              |
|                |                                                                  |                                                       |                  |                                        |                                            |              |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 8 (continued) - Performance Degradation for Infantry Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT   | MAJOR FUNCTION        | DESCRIPTION                                                       | WORKLOAD        | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |             |
|----------------|-----------------------|-------------------------------------------------------------------|-----------------|----------------------------------------|-------------------------------------------|-------------|
|                |                       |                                                                   |                 | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |             |
|                |                       |                                                                   |                 |                                        | 020°F(-7°C)                               | 050°F(10°C) |
| Bn HQ (Combat) | Site displacement (4) | Hasty, 500 meters                                                 | Moderate        | 5 min                                  | 5 min                                     | 15 min      |
|                | Site emplacement      | Hasty, erect antenna                                              | Heavy           | 10 min                                 | 20 min                                    | 60 min      |
|                | Displacement          | Move of 10 km or more, time from notification to march order      | Heavy           | 35 min (6)                             | 70 min                                    | 210 min     |
|                | Bn Maintenance (5)    | Emplacement, time to become operational upon arrival at new site. | Deliberate, POL | Immediate                              | Immediate                                 | Immediate   |
|                |                       |                                                                   | Ammo            | Immediate                              | Immediate                                 | Immediate   |
|                |                       | Mess                                                              | 45 min          | 90 min                                 | 270 min                                   |             |
|                |                       | Maintenance                                                       | Heavy           | 2 hrs                                  | 4 hrs                                     | 12 hrs      |

(1) Bn Maintenance Co assumed to be 15 km back of FEBA.

(2) Bn resupply vehicles will travel as far as reserve company area and refuel vehicles or transfer ammunition to company vehicles.

(3) Ammunition arrives at the Bn crated and palletized. Bn breaks down the ammunition for specific company requests. Transfers of all ammunition below Bn are manual.

(4) Bn commander operates out of an M113 (stretch). Major task for this unit is the erection and dismantling of an M292 antenna. Generally located about 2 km back of company positions.

(5) Generally 20 km back of the FEBA.

(6) Road march time is not included.

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 8a - Performance Degradation Data for Infantry Units in a Chemical Warfare (CW) Environment.\*\*

| TYPE OF UNIT | MAJOR FUNCTION                                                                                             | DESCRIPTION                                                  | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |               |
|--------------|------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------|----------|----------------------------------------|--------------------------------------------|---------------|
|              |                                                                                                            |                                                              |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |               |
|              |                                                                                                            |                                                              |          |                                        | 020°F (-7°C)                               | 085°F (29°C)  |
| TOW Crew     | Firing Operation                                                                                           | (1) Mount TOW on M113A1 (TOW) for extended travel            |          | (See Note 1)                           |                                            | (See Note 2)  |
|              |                                                                                                            | (2) Engage target from extended travel                       |          | 2:16                                   |                                            | 5:00          |
|              |                                                                                                            | (3) Cease fire/out of action and move out in extended travel |          | 0:50                                   |                                            | 1:23          |
|              |                                                                                                            | (4) Dismount TOW from extended travel                        |          | 0:59                                   |                                            | 1:16          |
|              |                                                                                                            | (5) Engage target                                            |          | 0:60                                   |                                            | 1:56          |
|              |                                                                                                            | (6) Cease fire/out of action                                 |          | 0:19                                   |                                            | 0:44          |
|              |                                                                                                            | TOTAL ELAPSED TIME IN MINUTES                                |          | 0:16<br>5:50                           |                                            | 0:16<br>10:35 |
|              | Note 1: Condition is ready MOPP 1 = Soldiers carry protective mask; other MOPP gear is readily accessible. |                                                              |          |                                        |                                            |               |
|              | Note 2: Temp. of test was 75°F                                                                             |                                                              |          |                                        |                                            |               |
|              | **Information supplied in letter ATSH-CO-MS-C, dtd 20 Feb 81.                                              |                                                              |          |                                        |                                            |               |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 9 - PERFORMANCE DEGRADATION DATA FOR MEDICAL UNITS IN A CHEMICAL WARFARE (CW) ENVIRONMENT.

| TYPE OF UNIT    | MAJOR FUNCTION                                        | DESCRIPTION                                                                                           | WORKLOAD          | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                                                                              |
|-----------------|-------------------------------------------------------|-------------------------------------------------------------------------------------------------------|-------------------|----------------------------------------|--------------------------------------------|------------------------------------------------------------------------------|
|                 |                                                       |                                                                                                       |                   | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |                                                                              |
|                 |                                                       |                                                                                                       |                   |                                        | @20°F (-7°C)                               | @50°F (10°C) @85°F (29°C)                                                    |
| Medical Company | Establish clearing Station (able to receive patients) | To be minimally operational: <sup>1</sup><br>In open area <sup>2</sup><br>In wooded area <sup>3</sup> | Moderate to heavy | 2.5 hrs <sup>4</sup><br>3.5 hrs        | 2.5 - 5 hrs <sup>5</sup><br>3.5 - 7 hrs    | 2.5 - 7.5 hrs 7.5 - 15 hrs <sup>6</sup><br>3.5 - 10.5 hrs 10.5 - 21 hrs      |
|                 |                                                       | For entire clearing station to be operational:<br>In open area<br>In wooded area                      | Moderate to Heavy | 5.5 hrs<br>6.5 hrs                     | 5.5 - 11 hrs<br>6.5 - 13 hrs               | 5.5 - 16.5 hrs 16.5 - 33 hrs <sup>6</sup><br>6.5 - 19.5 hrs 19.5 - 39 hrs    |
|                 | Disestablish clearing Station (receiving patients).   | Minimally operational <sup>8</sup><br>In open area<br>In wooded area                                  | Moderate to Heavy | 2 hrs<br>2.5 hrs                       | 2 - 4 hrs<br>2.5 - 5 hrs                   | 2 - 6 hrs 6 - 12 hrs <sup>6</sup><br>2.5 - 7.5 hrs 7.5 - 15 hrs <sup>6</sup> |
|                 |                                                       | Complete<br>In open area<br>In wooded area                                                            | Moderate to Heavy | 4 hrs<br>4.5 hrs                       | 4 - 8 hrs<br>4.5 - 9 hrs                   | 4 - 12 hrs 12 - 24 hrs <sup>6</sup><br>4.5 - 13.5 hrs 13.5 - 27 hrs          |
|                 |                                                       |                                                                                                       |                   |                                        |                                            |                                                                              |
|                 |                                                       |                                                                                                       |                   |                                        |                                            |                                                                              |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc., unless otherwise noted.

Table 9 (continued) - Performance Degradation Data for Medical Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                                    | MAJOR FUNCTION                                                                | DESCRIPTION                     | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |              |
|-----------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------------|----------|----------------------------------------|--------------------------------------------|--------------|--------------|
|                                                                 |                                                                               |                                 |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |              |
|                                                                 |                                                                               |                                 |          |                                        | 820°F (-7°C)                               | 850°F (10°C) | 865°F (29°C) |
| Medical Platoon/<br>Section of<br>Combat/Combat<br>Support Unit | Establish Battalion's<br>Aid Station (BAS):<br>For Level 1 Unit <sup>10</sup> | In M51 Shelter <sup>11</sup>    | Moderate | 20 min <sup>12</sup>                   | 30 min                                     | 30 min       | 1.5 hrs      |
|                                                                 |                                                                               | Under tentage <sup>13</sup>     | Moderate | 20 min                                 | 20 min                                     | 20 min       | 1 hr         |
|                                                                 |                                                                               | Under tarp/shelter/lean-to      | Light    | 10 min                                 | 10 min                                     | 10 min       | 18 min       |
|                                                                 |                                                                               | In an organic vehicle           | Light    | 5 min                                  | 5 min                                      | 5 min        | 9 min        |
|                                                                 |                                                                               | In M51 Shelter                  | Moderate | 60 min                                 | 60 min                                     | 60 min       | 3 hrs        |
|                                                                 |                                                                               | Under tentage                   | Moderate | 30 min                                 | 30 min                                     | 30 min       | 1.5 hrs      |
|                                                                 | Disestablish BAS: <sup>15</sup><br>For Level 1 Unit                           | Under tarp/shelter/lean-to      | Light    | 15 min                                 | 15 min                                     | 15 min       | 25 min       |
|                                                                 |                                                                               | In an organic vehicle           | Light    | 10 min                                 | 10 min                                     | 10 min       | 18 min       |
|                                                                 |                                                                               | From M51 Shelter                | Moderate | 30 min                                 | 30 min                                     | 30 min       | 1.5 hrs      |
|                                                                 |                                                                               | From under tentage              | Moderate | 20 min                                 | 20 min                                     | 20 min       | 1 hr         |
|                                                                 |                                                                               | From under tarp/shelter/lean-to | Light    | 10 min                                 | 10 min                                     | 10 min       | 18 min       |
|                                                                 |                                                                               | From an organic vehicle         | Light    | 5 min                                  | 5 min                                      | 5 min        | 9 min        |
|                                                                 | For Level 2 Unit                                                              | From M51 Shelter                | Moderate | 60 min                                 | 60 min                                     | 60 min       | 3 hrs        |
|                                                                 |                                                                               | From under tentage              | Moderate | 30 min                                 | 30 min                                     | 30 min       | 1.5 hrs      |
|                                                                 |                                                                               | From under tarp/shelter/lean-to | Light    | 15 min                                 | 15 min                                     | 15 min       | 25 min       |
|                                                                 |                                                                               | From an organic vehicle         | Light    | 10 min                                 | 10 min                                     | 10 min       | 18 min       |

\*Assuming normal duty uniform and relatively local conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

- 1 Minimally operational medical company clearing station includes a receiving and disposition area, emergency treatment area, one OR, CMS, laboratory, X-ray, and one ward.
- 2 Open area means flat ground that does not require further preparation.
- 3 Wooded area means light underbrush that must be cleared but trees do not have to be removed. Times do not include that required for camouflage, or installing stoves and flooring.
- 4 If areas not previously reconnoitered, add 0.5 - 1 hr to times.
- 5 Shorter time based on moderate workload; longer time (computed) based on heavy workload. (Applies to all time ranges given).
- 6 Add 25-30% more time for those portions of operations conducted at night.
- 7 Patients being received are only referred to another facility. Other patients are being evacuated.
- 8 Only that portion of unit required to establish operations at a new site disestablished.
- 9 Capable of receiving and treating patients to a level of care designed for a BAS.
- 10 Minimum tasks that must be performed before a unit can be classified as combat ready.
- 11 M51 shelter is not erected unless a chemical attack is expected and the area is to be occupied in excess of 6 - 8 hours.
- 12 Times do not include the establishment of a helicopter landing area.
- 13 Tentage is not erected unless the occupation of the area is expected to be in excess of 8 - 10 hours, or there is a need for protection from inclement weather.
- 14 Minimum tasks that must be performed before a unit can be classified as having attained Level 2 proficiency.
- 15 To load equipment, prepare patients for evacuation, and be ready to move to new location.

TABLE 9a- Performance Degradation Data for Medical Service Units in a Chemical Warfare (CW) Environment.\*\*

| TYPE OF UNIT                                             | MAJOR FUNCTION                     | DESCRIPTION                                     | WORKLOAD         | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |              |
|----------------------------------------------------------|------------------------------------|-------------------------------------------------|------------------|----------------------------------------|--------------------------------------------|--------------|--------------|
|                                                          |                                    |                                                 |                  | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |              |
|                                                          |                                    |                                                 |                  |                                        | 020°F (-7°C)                               | 050°F (10°C) | 085°F (29°C) |
| Medical Service Detachment, 8 people, usually 2 men/team | Preventive medicine inspection (1) | Basic, company size unit                        | Moderate         | .5 day                                 | .5 day                                     | .5 day       | 1 day        |
|                                                          | Mosquito survey (2)                | Battalion size unit                             | Moderate         | 2 days                                 | 2 days                                     | 2 days       | 3 days       |
|                                                          | Inspect water points               | For Division size element                       | Moderate -       | 1.5 days (3)                           | 1.5 days                                   | 1.5 days     | 2 days       |
|                                                          | Investigate outbreak of disease    | Division size area                              | Moderate         | 1 day                                  | 1 day                                      | 1 day        | 1.5 days     |
|                                                          |                                    | Interview people, both sick and well            | Light            | 1 day                                  | 1 day                                      | 1 day        | 1.5 days     |
|                                                          |                                    | Develop statistics                              | Light            | 1 day                                  | 1 day                                      | 1 day        | 1.5 days     |
|                                                          |                                    | Investigate causes; initiate corrective actions | Moderate - Light | 1 day                                  | 1 day                                      | 1 day        | 1.5 days     |
|                                                          | Inspect ration break - down points | Within Division                                 | Moderate - Light | .5 day                                 | .5 day                                     | .5 day       | 1 day        |
|                                                          | Spray personnel for lice problem   | Battalion size unit                             | Moderate         | 1 day                                  | 1 day                                      | 1 day        | 1.5 days     |
|                                                          | Inspect landfill                   |                                                 | Moderate         | .5 day                                 | .5 day                                     | .5 day       | 1 day        |
|                                                          | Inspect hospital                   |                                                 | Moderate         | 1 day                                  | 1 day                                      | 1 day        | 1.5 days     |
|                                                          | Maintenance, PM, jeep-type vehicle | Normal                                          | Moderate - Light | 10 min                                 | 10 min                                     | 10 min       | 15 min       |
|                                                          |                                    |                                                 |                  | inappropriate under MOPP 4 conditions; |                                            |              |              |

\*\*Reference 27 suggested that several of these tasks would be more involved in preventing heat stress.

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

- (1) Includes inspection of kitchen, garbage disposal, latrines, insect/rodent control, water treatment, laundries, and check of immunization of personnel.
- (2) Includes collection of mosquitoes and larvae, identify specimens, and recommend control operations (spray, drain standing water, cut grass, etc.).
- (3) One day to do survey; one-half day to perform analyses (after collection).

TABLE 10 - Performance Degradation Data for Military Police in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | MAJOR FUNCTION                 | DESCRIPTION             | WORKLOAD       | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |            |              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|-------------------------|----------------|----------------------------------------|--------------------------------------------|------------|--------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                |                         |                | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |            |              |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                |                         |                |                                        | 020°F (-7°C)                               | 0°F (10°C) | 085°F (29°C) |
| Variable (1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Convoy escort (2)              | Ammunition convoy       | Light/Moderate | N/A (3)                                | N/A                                        | N/A        | N/A          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Traffic control                | At intersections        | Moderate       | N/A                                    | N/A                                        | N/A        | N/A          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                | At river crossings      | Moderate       | N/A                                    | N/A                                        | N/A        | N/A          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Provide security, rear areas   | Respond to infiltrators | Moderate       | N/A                                    | N/A                                        | N/A        | N/A          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Provide security, command post |                         | Moderate       | N/A                                    | N/A                                        | N/A        | N/A          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Prisoner escort                | To POW camp             | Moderate       | N/A                                    | N/A                                        | N/A        | N/A          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Guard POWs                     | At collection points    | Light/Moderate | N/A                                    | N/A                                        | N/A        | N/A          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Law enforcement                | Within cities/towns     | Light/Moderate | N/A                                    | N/A                                        | N/A        | N/A          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Straggler control              | Civilian population     | Light/Moderate | N/A                                    | N/A                                        | N/A        | N/A          |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Maintain stockade              | In war zone             | Light/Moderate | N/A                                    | N/A                                        | N/A        | N/A          |
| <p>(1) Unit size/number of personnel will vary depending upon the magnitude and severity of the task, e.g., the more POWs captured, the greater the number of guards required; the larger the convoy, the more personnel and vehicles required to provide security; etc.</p> <p>(2) Insure road is open and clear (safe). In cooperation with combat forces.</p> <p>(3) Times are not clearly defined as these functions are essentially continuous. Intensity of effort and duration of effort will vary in proportion to the size of the problem.</p> |                                |                         |                |                                        |                                            |            |              |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 11- Performance Degradation Data for Ordnance Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                 | MAJOR FUNCTION                                                        | DESCRIPTION                                    | WORKLOAD       | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |
|----------------------------------------------|-----------------------------------------------------------------------|------------------------------------------------|----------------|----------------------------------------|--------------------------------------------|--------------|
|                                              |                                                                       |                                                |                | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |
|                                              |                                                                       |                                                |                | @20°F (-7°C)                           | @50°F (10°C)                               | @85°F (29°C) |
| Ammunition Supply Company                    | Site occupation hasty (1)                                             | Map recon (prior)                              | Light          | 30 min                                 | 30 min                                     | 50 min       |
|                                              |                                                                       | Once site has been selected                    | Heavy          | 25 min                                 | 75 min                                     | 150 min      |
|                                              |                                                                       | Establish security                             | Heavy          | 30 min                                 | 90 min                                     | 180 min      |
|                                              | Site occupation, deliberate (1)                                       | Map recon (prior)                              | Light          | 30 min                                 | 30 min                                     | 50 min       |
|                                              |                                                                       | Physical inspection of site                    | Light/Moderate | 2-2.5 hrs                              | 2-2.5 hrs                                  | 3.5-4.3 hrs  |
| Special Weapons Company                      | Move to a deliberate site, start to finish, Distribute ammunition (2) | Select stockage points                         | Light/Moderate | 30-45 min                              | 30-45 min                                  | 50-80 min    |
|                                              |                                                                       | 15 km distance                                 | Heavy          | 6 hrs                                  | 12 hrs                                     | 36 hrs       |
|                                              |                                                                       | For artillery battery                          | Heavy          | 30-45 min                              | 60-90 min                                  | 180-270 min  |
|                                              | Move 15 km, start to finish (3)                                       | At night                                       | Heavy          | 3-3.5 hrs                              | 6-7 hrs                                    | 18-21 hrs    |
|                                              |                                                                       | If leave repair items plus any excess materiel | Heavy          | 4 hrs                                  | 8 hrs                                      | 24 hrs       |
| Maintenance company (Direct forward support) | Displacement                                                          | If take along all materiel                     | Heavy          | 24 hrs                                 | 48 hrs                                     | 144 hrs      |
|                                              |                                                                       | Occupy new area                                | Heavy          | 3 hrs                                  | 6 hrs                                      | 18 hrs       |
|                                              |                                                                       | Change power pack in M113 APC                  | Heavy          | 3 hrs                                  | 6 hrs                                      | 18 hrs       |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 11 (continued). Performance Degradation Data for Ordnance Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                     | MAJOR FUNCTION                                                    | DESCRIPTION                                    | WORKLOAD                                                                                                                              | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |              |
|--------------------------------------------------|-------------------------------------------------------------------|------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|--------------------------------------------|--------------|--------------|
|                                                  |                                                                   |                                                |                                                                                                                                       | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |              |
|                                                  |                                                                   |                                                |                                                                                                                                       |                                        | @20°F (-7°C)                               | @50°F (10°C) | @85°F (29°C) |
| Maintenance Unit<br>company-size<br>(124 people) | Change power pack in M113 APC                                     | w/ untrained 3-man team                        | Heavy                                                                                                                                 | 6 hrs                                  | 12 hrs                                     | 18 hrs       | 36 hrs       |
|                                                  | Change cannon                                                     | 155mm towed howitzer, untrained team (4)       | Heavy                                                                                                                                 | 3-4 hrs                                | 6-8 hrs                                    | 9-12 hrs     | 18-24 hrs    |
|                                                  | Change recoil mechanism                                           | w/trained team                                 | Heavy                                                                                                                                 | 2-2.5 hrs                              | 4-5 hrs                                    | 6-7.5 hrs    | 12-15 hrs    |
|                                                  |                                                                   | 155mm, towed howitzer, (5) untrained team      | Heavy                                                                                                                                 | 8 hrs                                  | 16 hrs                                     | 24 hrs       | 48 hrs       |
|                                                  |                                                                   | Establish a maintenance unit area              | Includes placement of equipment and material, erection of maintenance facilities, and begin process for receiving supported equipment | Heavy                                  | 4.5 hrs                                    | 9.0 hrs      | 13.5 hrs     |
|                                                  | Perform technical inspections                                     | M60 series tank by 4 people                    | Moderate                                                                                                                              | 1 hr max                               | 1 hr max                                   | 1 hr max     | 3 hr max     |
|                                                  |                                                                   | M109 howitzer by 4 people                      | Moderate                                                                                                                              | 1 hr max                               | 1 hr max                                   | 1 hr max     | 3 hrs max    |
|                                                  | Perform direct support repairs                                    | M151A1 truck by 2 people                       | Moderate                                                                                                                              | 30 min max                             | 30 min max                                 | 30 min max   | 90 min max   |
|                                                  |                                                                   | Replace transmission assembly, M60 series tank | Heavy                                                                                                                                 | 16.5 man hrs                           | 33 man hrs*                                | 49.5 man hrs | 99 man hrs   |
|                                                  |                                                                   | Repair engine in M113 series tracked vehicle   | Heavy                                                                                                                                 | 9.3 man hrs                            | 18.6 man hrs                               | 27.9 man hrs | 55.8 man hrs |
|                                                  | Replace clutch disk and pressure plate, 5-ton M52A1 truck tractor | Heavy                                          | 7.8 man hrs                                                                                                                           | 15.6 man hrs                           | 23.4 man hrs                               | 46.8 man hrs |              |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 11 (continued)- Performance Degradation Data for Ordnance Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT | MAJOR FUNCTION              | DESCRIPTION                                                                            | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |                         |
|--------------|-----------------------------|----------------------------------------------------------------------------------------|----------|----------------------------------------|-------------------------------------------|-------------------------|
|              |                             |                                                                                        |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |                         |
|              |                             |                                                                                        |          |                                        | 020°F(-7°C)                               | 050°F(10°C) 085°F(29°C) |
|              | Perform recovery operations | On mined or terrain stuck vehicle; includes rigging 2.1 mechanical advantage; 4 people | Heavy    | 32 min                                 | 64 min                                    | 96 min 192 min          |
|              | Provide DX/float service    | Process M151A1 carburetor for DX, 1 person                                             | Light    | 20 min                                 | 20 min                                    | 35 min                  |
|              |                             | Process and issue float assets in return for an unserviceable asset, 1 person          | Light    | 60 min                                 | 60 min                                    | 105 min                 |

(1) Issues can be made immediately, from backs of trucks.

(2) "Normal" requirement; 155mm shells + propellant charges. (If palletized).

(3) About 40-45 vehicles; 5-ton trucks w/12-ton trailers. Convoy speed 25 mph (max).

(4) With a knowledgeable team that does not have a large amount of "hands-on" training.

(5) Includes 3 people + a wrecker + supervisory NCOs.

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 12 - Performance Degradation Data for Quartermaster Units in a Chemical Warfare (CW) Environment.\*\*

| TYPE OF UNIT                                                      | MAJOR FUNCTION                                                                      | DESCRIPTION                                                       | WORKLOAD       | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS  |                                            |                                                           |
|-------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------|----------------|-----------------------------------------|--------------------------------------------|-----------------------------------------------------------|
|                                                                   |                                                                                     |                                                                   |                | W/O PROTECTIVE CLOTHING*                | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |                                                           |
|                                                                   |                                                                                     |                                                                   |                |                                         | 020°F (-7°C)                               | 085°F (29°C)                                              |
| Supply & Service Company<br>Forward Supply Section (FSS) - 18 men | Receive Class I and selected Class IV supplies                                      | On-going mission which depends on the volume and size of supplies | Heavy          | Variable                                | Add 15-20 min/hr of working time           | Add ~50 min per hr of working time                        |
|                                                                   | Set up FSS Supply point                                                             | Includes tents, tarpaulins, camouflage nets, open storage         | Heavy          | 6-8 hrs (based on mission requirements) | 7-9 hours                                  | 8-10 hours                                                |
|                                                                   | Receive Class II and selected Class IV and VII supplies, and storage of these items | As with Class I above                                             | Heavy          | Variable                                | Add 15-20 min/hr of working time           | Add ~50 min per hr of working time                        |
|                                                                   | Transmit receiving documents to the DMMC                                            | As needed to update DMMC transaction register                     | Light          | 3-5 min per transaction                 | Add 5-10 min per hr of working time        | Add ~20 min per hr of working time                        |
| FSS-18 men                                                        | Issue of Class I, II, IV, and VII supplies                                          | Based on amount requested on the issue documents: Class I         | Moderate-Heavy | ~1000 rations/hr                        | Add 15-20 min/hr of working time           | Add ~30-40 min/hr of working time                         |
|                                                                   |                                                                                     | Class II, IV, VII                                                 |                | ~2-4 short tons/hr                      | Add 15-20 min per hr of working time       | Add ~30-40 min/hr of working time                         |
|                                                                   | Receive, store, issue Class III supplies (POL)                                      |                                                                   | Moderate-Heavy | 1200 gal/hr                             | Add 20-25 min/hr of working time           | Add 40-50 min per 1200 gals received or issued            |
|                                                                   | Decontamination of Equipment and/or preparation to move out                         | To move out only: Class I, Class II, IV, VII, Class III           | Heavy          | 2 hrs<br>4-6 hours<br>3-5 hours         | +3 hours<br>+4-6 hours<br>+2 hours         | +6 hours<br>+8-12 hours<br>+4-6 hours (1)<br>+2 hours (1) |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 12 (continued) - Performance Degradation Data for Quartermaster Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                             | MAJOR FUNCTION                                                 | DESCRIPTION                                       | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |                         |             |
|----------------------------------------------------------|----------------------------------------------------------------|---------------------------------------------------|----------|----------------------------------------|-------------------------------------------|-------------------------|-------------|
|                                                          |                                                                |                                                   |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |                         |             |
|                                                          |                                                                |                                                   |          |                                        | @20°F(-7°C)                               | @50°F(10°C)             | @85°F(29°C) |
| <u>Main Supply Platoon</u><br><br>Class I and IV Section | Position equipment and materiel                                |                                                   | Heavy    | 4-6 hours                              | Add 2 hours                               | Add 4 hours             |             |
|                                                          | Position tent, dunnage, and other materiel                     |                                                   | Heavy    | 3-5 hours                              | +1.5 hours                                | +3 hours                |             |
|                                                          | Store division reserve stocks                                  | Based on MHE equipment available                  | Heavy    | 2-4 short tons per hour                | Add 30 min to each hour                   | Add 50 min to each hour |             |
|                                                          | Break bulk (palletized) supplies for storage or issue          | Class I                                           | Heavy    | 2000 rations/hr                        | Add 30 min/hr                             | Add 50 min/hr           |             |
|                                                          | Issue Class I and IV                                           | Class IV<br>As per mission requirement:           | Heavy    | 2 short tons/hr                        | Add 45-60 min/hr                          | Add 90-120 min/hr       |             |
| Class III Section                                        | Prepare terrain and establish the Fuel System Supply Point     | Class I                                           | Heavy    | 3-4000 rations per hour                | Add 15 min/hr                             | Add 50 min per hour     |             |
|                                                          | 10,000 gal system w/ 350 GPM pump                              | Class IV                                          | Heavy    | 4-5 short tons per hour                | Add 30-45 min/hr                          | Add 45-60 min/hr        |             |
|                                                          | Fuel a 30-vehicle convoy                                       |                                                   | Heavy    | 6-8 hours                              | Add 2 hours                               | Add 4 hours             |             |
| Class II, IV, and VII Section                            | Store supplies, unclassified maps, and division reserve stocks | In support for division size, with MHE capability | Heavy    | ~ 1 hour                               | Add 15 min/hr                             | Add 30 min/hr           |             |
|                                                          |                                                                |                                                   | Heavy    | ~ 18-24 hours                          | Add 4-6 hours                             | Add 8-10 hours          |             |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 12 (Continued) - Performance Degradation Data for Quartermaster Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                           | MAJOR FUNCTION                                                          | DESCRIPTION                                               | WORKLOAD       | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |                     |                 |
|----------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------|----------------|----------------------------------------|-------------------------------------------|---------------------|-----------------|
|                                        |                                                                         |                                                           |                | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |                     |                 |
|                                        |                                                                         |                                                           |                |                                        | @20°F (-7°C)                              | @50°F (10°C)        | @85°F (29°C)    |
| Central Issue Facility (CIF)           | Issue Class II, IV, and VII supplies                                    | With MHE                                                  | Heavy          | 12-14 short tons/hr                    | Add 2-4 hours                             | Add 2-4 hours       | Add 4-6 hours   |
|                                        | Prepare Class II and selected Class IV and VII items for shipment       | Document, packaging, palletizing                          | Heavy          | 8-9 short tons/hr                      | Add 1.5-3 hrs                             | Add 1.5-3 hrs       | Add 3-5 hrs     |
|                                        | Establish the salvage collection point                                  | For division                                              | Heavy          | 4-6 hours                              | Add 1-1.5 hours                           | Add 1-1.5 hours     | Add 2-3 hours   |
|                                        | Position tents, dunnage, and administrative equipment                   |                                                           | Heavy          | 2-3 hours                              | Add 45-60 min                             | Add 44-60 min       | Add 1.5-2 hours |
|                                        | Position CIF stocks (clothing, TA-50, etc.)                             |                                                           | Heavy          | 4-5 hours                              | Add 1-2 hours                             | Add 1-2 hours       | Add 2-4 hours   |
|                                        | Receive clothing and equipment from a company size unit, i.e., turn-ins | Based on 3 sets of clothing per man for a 250-man company | Moderate-Heavy | 2-3 hours                              | Add 45-60 min                             | Add 45-60 min       | Add 1.5-2 hours |
| Clothing Exchange & Bath Section (CEB) | Issue of new clothing for above unit plus equipment (TA-50)             | Based on 3 sets of clothing per man for a 250-man company | Moderate-Heavy | 2-3 hours                              | Add 45-60 min                             | Add 45-60 min       | Add 1.5-2 hours |
|                                        | Establish undressing, delousing, bathing, and dressing areas            | By an 8-man team                                          | Heavy          | 2.5-3 hours                            | Add 1-1.5 hrs                             | Add 1-1.5 hrs       | Add 2-3 hrs     |
|                                        | Position clothing exchange stocks                                       |                                                           | Heavy          | 1-2 hours                              | Add 30 min                                | Add 30 min          | Add 45-60 min   |
|                                        | Connect bath equipment, 3000-gal blivet, hoses, pump, pallets, etc.     | By an 8-man team                                          | Moderate-Heavy | 1.5-2 hours                            | Add 0.75-1.25 hours                       | Add 3/4-1 1/4 hours | Add 1-1.5 hrs   |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 12 (continued) - Performance Degradation Data for Quartermaster Units in a Chemical Warfare (CW) Environment\*

| TYPE OF UNIT                                                                    | MAJOR FUNCTION                                                     | DESCRIPTION                                                               | WORKLOAD       | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                                 |                                                 |                                                   |
|---------------------------------------------------------------------------------|--------------------------------------------------------------------|---------------------------------------------------------------------------|----------------|----------------------------------------|-------------------------------------------------|-------------------------------------------------|---------------------------------------------------|
|                                                                                 |                                                                    |                                                                           |                | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE)      |                                                 |                                                   |
|                                                                                 |                                                                    |                                                                           |                |                                        | 020°F (-7°C)                                    | 050°F (10°C)                                    | 085°F (29°C)                                      |
| Graves Registration, Collection, Identification, and Evaluation Section (GRREG) | Prepare drainage system (Heavy labor, ditch digging)               | Under normal conditions                                                   | Heavy          | 1 hour                                 | Add 1 hour+                                     | Add 1 hour+                                     | Add 2 hours+                                      |
|                                                                                 | Operate shower equipment                                           | For 8 men to go through                                                   | Moderate       | 8-10 min                               | 15-20 min (2)                                   | 15-20 min (2)                                   | Add 20-45 min                                     |
|                                                                                 | Position tents and equipment                                       |                                                                           | Heavy          | 3-4 hours                              | Add 1 hour                                      | Add 1 hour                                      | Add 2 hours                                       |
|                                                                                 | Receive remains                                                    |                                                                           | Moderate       | 5-10 min/body                          | Add 5 min+ time to decontaminate remains (1 hr) | Add 5 min+ time to decontaminate remains (1 hr) | Add 10 min+ time to decontaminate remains (2 hrs) |
|                                                                                 | Identify remains                                                   | Based on condition and identification available                           | Light          | 5 min-hrs                              | Add minimum of 1/3 more time per body           | Add minimum of 1/3 more time per body           | Add minimum of 50% more time per body             |
|                                                                                 | Inventory personal effects                                         |                                                                           | Light*         | 5-10 min/body                          | Add 3-5 min                                     | Add 3-5 min                                     | Add 6-10 min per body                             |
| Supply and service company (SSS)                                                | Load and evacuate remains to a mortuary or to a temporary cemetery |                                                                           | Light-moderate | 5-10 min/body                          | Add 5 min/body                                  | Add 5 min per body                              | Add 10 min/body                                   |
|                                                                                 | Establish perimeter defense: Wire, foxholes, barriers, mines, etc. | Based on each of above sections being assigned a section of the perimeter | Heavy          | 8-10 hrs                               | Add 4-6 hrs                                     | Add 4-6 hrs <sup>(3)</sup>                      | Add 6-8 hrs                                       |
|                                                                                 | Camouflage area (natural + nets)                                   | Same as above                                                             | Heavy          | 4-6 hours                              | Add 1-2 hours                                   | Add 1-2 hours                                   | Add 2-4 hours                                     |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

1. Times reflect both decontamination of equipment and preparation to move out.
2. Time includes that required to decontaminate.
3. To include good overhead cover and protected positions.

\*This table was prepared entirely by CPT Andrew W. Knight, USATECOM, APG, MD.

TABLE 13 - Performance Degradation Data for Signal Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT               | MAJOR FUNCTION                                 | DESCRIPTION                                                                                               | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |             |
|----------------------------|------------------------------------------------|-----------------------------------------------------------------------------------------------------------|----------|----------------------------------------|--------------------------------------------|-------------|
|                            |                                                |                                                                                                           |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |             |
| Artillery Combat Battalion | Establish communications                       | Wire <sup>(1)</sup><br>FM <sup>(2)</sup><br>Erect antenna (RC-292)<br>AM <sup>(3)</sup>                   | Heavy    | <2 hours                               | <4 hours                                   | <12 hours   |
|                            |                                                |                                                                                                           |          | <30 min                                | <60 min                                    | <3 hours    |
|                            |                                                |                                                                                                           |          | <15 min                                | <30 min                                    | <1.5 hours  |
|                            |                                                |                                                                                                           |          | <1 hour                                | <2 hours                                   | <6 hours    |
|                            |                                                |                                                                                                           |          | 2 hrs max.                             | 4 hrs max.                                 | 12 hrs max. |
| Artillery Group HQ         | Establish communications to Battalion, 31 mile | Wire<br>Multichannel <sup>(4)</sup><br>Time of alert till begin to move<br>Become operational at new site | Heavy    | 3-4 hours                              | 6-8 hours                                  | 18-24 hours |
|                            |                                                |                                                                                                           |          | 2 hrs max.                             | 4 hrs max.                                 | 12 hrs max. |
|                            |                                                |                                                                                                           |          | 2 hrs max.                             | 4 hrs max.                                 | 12 hrs max. |
|                            |                                                |                                                                                                           |          | 2 hrs max.                             | 4 hrs max.                                 | 12 hrs max. |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 13 - (Continued) Performance Degradation Data for Signal Units in a Chemical Warfare (Cw) Environment.

| TYPE OF UNIT | MAJOR FUNCTION                                                                                                          | DESCRIPTION                                    | WORKLOAD                          | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                      |                       |
|--------------|-------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------------|----------------------------------------|--------------------------------------------|----------------------|-----------------------|
|              |                                                                                                                         |                                                |                                   | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |                      |                       |
|              |                                                                                                                         |                                                |                                   |                                        | 020°F (-7°C)                               | 050°F (10°C)         | 085°F (29°C)          |
| Signal Bn    | Establish communications (VHF) between Div Main, Div Arty, Tac CP, and forward Brigades (Each link a 12 channel system) | Minimum number of links to "fight the war."    | Heavy                             | 2 hrs max                              | 4 hrs max                                  | 6 hrs max            | 12 hrs max            |
|              |                                                                                                                         | Complete                                       | Heavy                             | 12 hrs max                             | 24 hrs max                                 | 36 hrs max           | 72 hrs max            |
|              |                                                                                                                         | Set up station                                 | Heavy                             | .5 hr                                  | 1 hr                                       | 1.5 hrs              | 3 hrs                 |
|              |                                                                                                                         | Get into net                                   | Heavy - Moderate                  | 1 hr                                   | 2 hrs                                      | 3 hrs                | 6 hrs                 |
|              | FM Station (Div - CG Cmd Net and Ops/Intel Net)                                                                         | Set up station w/RC-292 antenna w/whip antenna | Heavy Heavy                       | .5 hr 15 min                           | 1 hr 30 min                                | 1.5 hr 45 min        | 3 hrs 1.5 hr          |
|              |                                                                                                                         | Get into net w/RC-292 antenna w/whip antenna   | Heavy - Moderate Heavy - Moderate | 1 hr .5 hr                             | 2 hrs 1 hr                                 | 3 hrs 1.5 hrs        | 6 hrs 3 hrs           |
|              | Lay cable within Div Main Area (from Patch Panel (SB611))                                                               | Cable (26 pair) Wire (1 pair)                  | Heavy Heavy                       | 4 hrs max 2 hrs max                    | 8 hrs max 4 hrs                            | 12 hrs max 6 hrs max | 24 hrs max 12 hrs max |
|              | (1) Lay wire from Bn FDC to Batteries; usually less than 1 mi (usually in hundreds of yards).                           |                                                |                                   |                                        |                                            |                      |                       |
|              | (2) Erect antenna, connect to radio, open the net.                                                                      |                                                |                                   |                                        |                                            |                      |                       |
|              | (3) Erect doublet antenna, hook up generator, come into the net.                                                        |                                                |                                   |                                        |                                            |                      |                       |
|              | (4) Erect large antennas (horn, hydraulic type), perform alignment, get on correct frequency.                           |                                                |                                   |                                        |                                            |                      |                       |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 14 - Performance Degradation Data for Transportation Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                             | MAJOR FUNCTION                   | DESCRIPTION                 | WORKLOAD         | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |              |
|----------------------------------------------------------|----------------------------------|-----------------------------|------------------|----------------------------------------|--------------------------------------------|--------------|--------------|
|                                                          |                                  |                             |                  | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |              |
|                                                          |                                  |                             |                  |                                        | 020°F (-7°C)                               | 050°F (10°C) | 985°F (29°C) |
| Aviation Intermediate Maintenance Company <sup>(1)</sup> | Aircraft maintenance             | Periodic inspection         | Moderate - Heavy | Variable                               | Variable                                   | Variable     | Variable     |
|                                                          |                                  | Change engine               | Heavy            | 1-3 days <sup>(2)</sup>                | 2-4 days                                   | 2-4 days     | 3-5 days     |
|                                                          |                                  | Phase inspection            | Moderate - Heavy | 2-7 days                               | 3-8 days                                   | 3-8 days     | 4-10 days    |
|                                                          |                                  | Test flight                 | Moderate         | 1 hr                                   | 1 hr                                       | 1 hr         | 3 hrs        |
|                                                          |                                  | Avionics, check             | Moderate         | 15-30 min                              | 15-30 min                                  | 15-30 min    | 45-90 min    |
|                                                          |                                  | Avionics, trouble-shoot     | Moderate         | 1-2 hrs                                | 1-2 hrs                                    | 1-2 hrs      | 3-6 hrs      |
|                                                          |                                  | Change rotor blades:        |                  |                                        |                                            |              |              |
|                                                          |                                  | To remove                   | Heavy            | 2-4 hrs                                | 4-8 hrs                                    | 6-12 hrs     | 12-24 hrs    |
|                                                          |                                  | To replace                  | Heavy            | 2 hrs                                  | 4 hrs                                      | 6 hrs        | 12 hrs       |
|                                                          |                                  | Blade balance               | Moderate         | 1/2-1 hr                               | 1/2-1 hr                                   | 1/2-1 hr     | 1/2-1 hr     |
|                                                          | Aircraft recovery <sup>(3)</sup> | Blade track                 | Moderate         | 45 min                                 | 45 min                                     | 45 min       | 135 min      |
|                                                          |                                  | Ground check                |                  | 30 min                                 | 30 min                                     | 30 min       | 1.5 hrs      |
|                                                          |                                  | Test flight                 |                  | 15 min                                 | 15 min                                     | 15 min       | 45 min       |
|                                                          |                                  | Time on site <sup>(4)</sup> | Heavy            | 1 hr                                   | 2 hrs                                      | 3 hrs        | 6 hrs        |
|                                                          |                                  | Preparation for removal     | Heavy            | 20 min                                 | 40 min                                     | 60 min       | 120 min      |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

TABLE 14 (continued) - Performance Degradation Data for Transportation Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | MAJOR FUNCTION                                              | DESCRIPTION            | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                           |             |             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|------------------------|----------|----------------------------------------|-------------------------------------------|-------------|-------------|
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                             |                        |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4(FULL PROTECTIVE ENSEMBLE) |             |             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                             |                        |          |                                        | @20°F(-7°C)                               | @50°F(10°C) | @85°F(29°C) |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Move to new site, with in 50-100 miles of support units (5) | Prepare to move        | Heavy    | 1 day                                  | 2 days                                    | 3 days      | 6 days      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                             | Actual movement        | Moderate | 1 day                                  | 1 day                                     | 1 day       | 3 days      |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                             | Become operational (6) | Heavy    | 1-2 days                               | 2-4 days                                  | 3-6 days    | 6-12 days   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                             |                        |          |                                        |                                           |             |             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                             |                        |          |                                        |                                           |             |             |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                             |                        |          |                                        |                                           |             |             |
| <p>(1) Consists of 250-300 men, 4 platoon elements, operating from a semi-fixed facility.</p> <p>(2) Time required depends on type of airframe.</p> <p>(3) Uses CH-47 + 10-man rigging crew + UH-1. Crew goes out and prepares aircraft for recovery; CH-47 comes in, hooks up, removes.</p> <p>(4) Travel time varies w/distance.</p> <p>(5) Unit operates at a 50-100 mile range of supported units. When move is made, the 50-100 mile range will usually be maintained.</p> <p>(6) Could actually operate from 2 sites (old and new) for period of 1 week (until finish previously started repairs).</p> |                                                             |                        |          |                                        |                                           |             |             |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

Table 14a - Performance Degradation Data for Transportation Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                 | MAJOR FUNCTION                                                        | DESCRIPTION                                                                                        | WORKLOAD                               | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS         |                                            |                                          |                                            |
|----------------------------------------------|-----------------------------------------------------------------------|----------------------------------------------------------------------------------------------------|----------------------------------------|------------------------------------------------|--------------------------------------------|------------------------------------------|--------------------------------------------|
|                                              |                                                                       |                                                                                                    |                                        | W/O PROTECTIVE CLOTHING*                       | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |                                          |                                            |
|                                              |                                                                       |                                                                                                    |                                        |                                                | @20°F (-7°C)                               | @50°F (10°C)                             | @85°F (29°C)                               |
| TRANSOM (Transportation Command)             | Command and control of transportation units w/in theater (except MCA) | Staff assistance; coordination of transport services                                               | Light                                  | Continuous                                     | N/A (1)                                    | N/A (1)                                  | N/A (1)                                    |
| Transportation Movement Control Agency (MCA) | Operate Movement Control Centers (MCC)                                | Control movement of personnel and materiel in COMMZ; Perform highway traffic regulation w/in COMMZ | Light                                  | Continuous                                     | N/A (1)                                    | N/A (1)                                  | N/A (1)                                    |
| COSCOM MCC                                   | Command and control of Motor Trans. Bn.                               | Staff assistance; control movement of personnel and materiel w/in corps area.                      | Moderate                               | Continuous                                     | N/A (2)                                    | N/A (2)                                  | N/A (2)                                    |
| Transportation Motor Group:                  | Command and control of motor Bns.                                     | Staff assistance; coordinate transportation; supervise transportation                              | Light                                  | Continuous                                     | N/A (1)                                    | N/A (1)                                  | N/A (1)                                    |
| S2/S3                                        | Operations and training                                               | (a) Route recon<br>(b) Movement Plans                                                              | Heavy<br>Moderate                      | 2-4 hrs<br>5-8 hrs                             | N/A                                        | N/A                                      | N/A                                        |
| S <sup>4</sup>                               | Motor Maintenance                                                     | Maintenance procedures (general supervision of maintenance w/in motor Bns)                         | Moderate                               | 6-8 hrs                                        | 4-8 hrs<br>6-8 hrs                         | 6-12 hrs<br>6-8 hrs                      | 12-24 hrs<br>18-24 hrs                     |
| Medium Truck Company                         | Resupply of tactical and non-tactical units<br>Vehicle driver         | Short haul operations<br>Long haul operations<br>(a) Receive cargo<br>(b) Deliver cargo            | Heavy<br>Heavy<br>Moderate<br>Moderate | Continuous<br>Continuous<br>1-2 hrs<br>6-8 hrs | N/A (3)<br>N/A (3)<br>1-2 hrs<br>6-8 hrs   | N/A (3)<br>N/A (3)<br>1-2 hrs<br>6-8 hrs | N/A (3)<br>N/A (3)<br>3-5 hrs<br>18-24 hrs |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

Table 14a - (continued) - Performance Degradation Data for Transportation Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                            | MAJOR FUNCTION                      | DESCRIPTION                                                                                                     | WORKLOAD                         | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |                                 |                    |
|-----------------------------------------|-------------------------------------|-----------------------------------------------------------------------------------------------------------------|----------------------------------|----------------------------------------|--------------------------------------------|---------------------------------|--------------------|
|                                         |                                     |                                                                                                                 |                                  | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |                                 |                    |
|                                         |                                     |                                                                                                                 |                                  |                                        | 020°F (-7°C)                               | 050°F (10°C)                    | 085°F (29°C)       |
| Medium Truck Company                    | Vehicle driver                      | (c) Off load<br>(d) Maintenance                                                                                 | Moderate<br>Moderate             | 1-2 hrs<br>1-2 hrs                     | 1-2 hrs<br>1-2 hrs                         | 1-2 hrs<br>1-2 hrs              | 3-6 hrs<br>3-6 hrs |
|                                         | Platoon HQ                          | Coordinate cargo receipt<br>Accompany Movement<br>Off load                                                      | Moderate<br>Moderate<br>Moderate | 1-2 hrs<br>6-8 hrs<br>1-2 hrs          | 1-2 hrs<br>6-8 hrs<br>1-2 hrs              | 1-2 hrs<br>18-24 hrs<br>3-6 hrs | 3-6 hrs<br>3-6 hrs |
| Transportation Terminal Group           | Command and Super-vise Terminal Bns | Staff assistance;<br>coordinate services;<br>supervise operations                                               | Light to<br>Moderate             | Continuous                             | N/A <sup>(4)</sup>                         | N/A <sup>(4)</sup>              | N/A <sup>(4)</sup> |
|                                         | Terminal Bn                         | Command and super-vision of terminal service and terminal transfer companies                                    | Light                            | Continuous                             | N/A <sup>(5)</sup>                         | N/A <sup>(5)</sup>              | N/A <sup>(5)</sup> |
| Transportation Terminal Service Company | Discharge Vessels                   | (a) 1000 short tons of cargo daily<br>(b) Sort cargo by destination<br>(c) Account for cargo<br>(d) Store cargo | Heavy                            | Continuous                             | N/A <sup>(6)</sup>                         | N/A <sup>(6)</sup>              | N/A <sup>(6)</sup> |

\*Assuming normal duty uniform and relatively ideal conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

(1) Personnel not routinely exposed to adverse tactical conditions.

(2) Personnel of regulating teams could be exposed to significant amounts of contamination. Significant degradation would result and a great impact upon traffic congestion and the efficiency of motor transportation operations could be expected.

(3) High exposure risk for personnel (drivers). Exposure would likely produce a drastic decrease in rate of resupply and disrupt operations.

(4) Unit located at major transportation "choke points" (harbors, ports, terminals). Functions are mainly administrative/clerical w/heavy dependence upon data systems and telephonic communications. Personnel not routinely exposed to adverse conditions.

(5) Personnel routinely exposed to environment; heavily dependent upon data systems and telephonic communications.

(6) Personnel employed in built-up port areas or in "bare-beach" operations. Exposed to environment; would suffer high degree of degradation if required to operate in an NBC environment. Tasks are labor intensive, constraint of movement would significantly reduce efficiency.

Table 14b - Performance Degradation Data for Transportation Units in a Chemical Warfare (CW) Environment.

| TYPE OF UNIT                                         | MAJOR FUNCTION                                                                                                | DESCRIPTION                                            | WORKLOAD | TIMES REQUIRED TO ACCOMPLISH FUNCTIONS |                                            |              |
|------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|----------|----------------------------------------|--------------------------------------------|--------------|
|                                                      |                                                                                                               |                                                        |          | W/O PROTECTIVE CLOTHING*               | WHILE IN MOPP 4 (FULL PROTECTIVE ENSEMBLE) |              |
|                                                      |                                                                                                               |                                                        |          |                                        | 020°F (-7°C)                               | 050°F (10°C) |
| Transportation Motor Transport Bn:<br>Light Truck Co | Move general cargo and personnel; equipped with either 2½ or 5-ton trucks (if) 45 trucks available            | Local haul (about 15 mi forward), round trip per truck | Moderate | 5 hrs (2)                              | 5 hrs                                      | 15 hrs       |
|                                                      |                                                                                                               | Line haul (about 75 mi forward), round trip per truck  | Moderate | 10 hrs (3)                             | 10 hrs                                     | 30 hrs       |
| Medium Truck Co                                      | Move general cargo, bulk POL products, and refrigerated cargo; equipped with 45 semi-trailer combinations (4) | Local haul, about 15 mi forward, round trip per truck  | Moderate | 5 hrs (2)                              | 5 hrs                                      | 15 hrs       |
|                                                      |                                                                                                               | Line haul, about 75 mi forward, round trip per truck   | Moderate | 10 hrs (3)                             | 10 hrs                                     | 30 hrs       |
| Heavy Truck Co                                       | Move tanks and heavy or outsized cargo and vehicles, operating with 18 truck tractors and semi-trailers (5)   | Local haul, about 15 mi forward, round trip per truck  | Moderate | 5 hrs (2)                              | 5 hrs                                      | 15 hrs       |
|                                                      |                                                                                                               | Line haul, about 75 mi forward, round trip per truck   | Moderate | 10 hrs (3)                             | 10 hrs                                     | 30 hrs       |

\*Assuming normal duty uniform and relatively local conditions of daylight, moderate weather, trained troops, etc. (unless otherwise specified).

- (1) 2½-ton trucks loaded w/4 tons of cargo or 16 or 20 personnel per truck; 5-ton trucks loaded w/6 tons of cargo or 18 or 20 personnel per truck. On local hauls, both 2½- and 5-ton trucks haul 20 people; on line hauls, 2½-ton truck hauls 16 people and 5-ton truck hauls 18 people
- (2) Based on 4 round trips per day per truck (2 round trips per 10-hr shift, 1 round trip in 5 hours).
- (3) Based on 2 round trips per day per truck or 1 round trip per 10-hr shift.
- (4) 12 tons of cargo per semitrailer, 5000 gallons per tanker, or 6 tons of refrigerated cargo per vehicle.
- (5) Average load of 40 tons per truck.

TABLE 15 - CYCLIC WORK/REST VALUES (MINUTES) WITH NEGLIGIBLE HEAT CASULTIES.<sup>(1)</sup>

| MOPP<br>LEVEL | WORK<br>RATE | TEMPERATURE RANGES                       |                                                              |                                                |                                          |
|---------------|--------------|------------------------------------------|--------------------------------------------------------------|------------------------------------------------|------------------------------------------|
|               |              | 21 <sup>0</sup> C<br>(70 <sup>0</sup> F) | 21-26 <sup>0</sup> C<br>(70 <sup>0</sup> -79 <sup>0</sup> F) | 27-32 <sup>0</sup> C<br>(80-89 <sup>0</sup> F) | 33 <sup>0</sup> C<br>(90 <sup>0</sup> F) |
| 1             | Low          | (2)                                      | (2)                                                          | (2)                                            | (2)                                      |
|               | Moderate     | (2)                                      | (2)                                                          | 60/20                                          | 40/50                                    |
|               | Heavy        | (2)                                      | 60/15                                                        | 40/25                                          | 30/50                                    |
| 2             | Low          | (2)                                      | (2)                                                          | (2)                                            | 50/50                                    |
|               | Moderate     | (2)                                      | (2)                                                          | 50/35                                          | 30/60                                    |
|               | Heavy        | 60/30                                    | 45/30                                                        | 25/30                                          | (3)                                      |
| 3             | Low          | (2)                                      | (2)                                                          | (2)                                            | 60/30                                    |
|               | Moderate     | (2)                                      | 60/20                                                        | 40/35                                          | 30/50                                    |
|               | Heavy        | 40/20                                    | 35/30                                                        | (3)                                            | (3)                                      |
| 4             | Low          | (2)                                      | (2)                                                          | 40/30                                          | 20/50                                    |
|               | Moderate     | 40/20                                    | 30/25                                                        | 20/40                                          | (3)                                      |
|               | Heavy        | 20/25                                    | (3)                                                          | (3)(10/50)*                                    | (3)                                      |

(1) Data extracted from Table 5-2, page 5-12, of FM 21-40, C1, dated 14 October 1977 (Reference 8).

(2) Under these conditions any reasonable work/rest periods will suffice to prevent heat casualties.

(3) Under these conditions work time will be severely limited, and even very short periods of heavy work could result in heat casualties.

\*Estimated value employed in calculations.

TABLE 16 - WORK/REST TIMES (MINUTES)<sup>(1)</sup>

| <u>TEMPERATURE</u> | <u>WORK<br/>LOAD</u> | <u>BASELINE<sup>(2)</sup></u> |                      | <u>MOPP 4</u>        |                      |
|--------------------|----------------------|-------------------------------|----------------------|----------------------|----------------------|
|                    |                      | <u>WORK<br/>TIME</u>          | <u>REST<br/>TIME</u> | <u>WORK<br/>TIME</u> | <u>REST<br/>TIME</u> |
| -7°C<br>(10°F)     | LIGHT                | NHB <sup>(3)</sup>            | 15                   | NHB                  | 20                   |
|                    | MODERATE             | NHB                           | 15                   | NHB                  | 30                   |
|                    | HEAVY                | NHB                           | 15                   | 30                   | 30                   |
| 10°C<br>(50°F)     | LIGHT                | NHB                           | 15                   | NHB                  | 30                   |
|                    | MODERATE             | NHB                           | 15                   | NHB                  | 50                   |
|                    | HEAVY                | NHB                           | 15                   | 25                   | 50                   |
| 29°C<br>(85°F)     | LIGHT                | 180                           | 20                   | 60                   | ∞                    |
|                    | MODERATE             | 90                            | 50                   | 40                   | ∞                    |
|                    | HEAVY                | 25                            | 70                   | 15                   | ∞                    |

(1) Data extracted from Appendix H, Annex III, 61 JTCG/ME-75-13, pages H-56, H-57, and H-58 (Reference 24).

(2) Uniform is that normally worn in keeping with conditions; no NBC protection.

(3) NHB - No heat build-up; personnel can work for 2 hours or more and not build up sufficient heat to be degraded.

Table 16 provides a compilation of work/rest times extracted from Annex III to Appendix H of Report 61 JTCG/ME-75-13.<sup>24</sup> The data evolved from the Project MANDRAKE ROOT Addendum Study and are based solely upon heat stress. Allowable work time was derived by means of a calculation that considered the hourly heat build-up in man and the maximum allowable heat before stress conditions occur in man. Required rest time was calculated by taking into consideration the hourly heat build-up factor and the total heat loss due to wearing a particular protective ensemble. The work and rest times are absolute estimates. The amount of heat output associated with the designations of light, moderate, and heavy work loads are 150 Kcal/hr, 200 Kcal/hr, and 400 Kcal/hr, respectively.

Attempts to quantify the effects of factors other than heat stress have been hampered by a lack of empirical data,<sup>25</sup> and thus were not employed here. Among these other factors were visual acuity, respiratory stress, manual dexterity, and psychological effects.

The work/rest times shown in Tables 15 and 16 were applied to the function/time data of Tables 2-14, except in the case of the Quarter-master Units (Table 12)<sup>25</sup>, and in the case of the TOW crew (Table 8a)<sup>26</sup>. The manner in which this was done was essentially to add the recommended rest times to the time given as being required to accomplish the task without CW protective gear (for the appropriate workload and temperature). As examples, if the time required to perform a task requiring a heavy workload without CW gear was given as 60 minutes under relatively ideal conditions, the times to perform the same function at 20, 50 or 85°F (-7, 10 or 29°C) while in MOPP 4 were calculated as follows:

- At 20°F (-7°C), the cycle to complete the task consisted of 30 minutes of work plus 30 minutes of rest, followed by 30 minutes of work and an additional 30 minutes of rest. The total time calculated was 120 minutes, twice that expected to complete the task without the encumbrance of CW protective clothing.
- At 50°F (10°C), the cycle to complete the task consisted of 25 minutes of work followed by 50 minutes of rest, another 25 minutes of work followed by 50 minutes of rest, and finally 10 minutes of work followed by a 20 minute rest period. The total time calculated to complete the task was 180 minutes, three times the expected time under normal conditions.
- At 85°F (29°C), no work/rest times were given. Therefore, an extrapolated value was incorporated into Table 15 and employed in the calculations. It was decided to use a 50 minute rest period for every 10 minutes of heavy work. (This 10/50 value is probably conservative and the situation is likely to be worse, i.e., more time to rest and recover will be necessary.) Thus, the total time calculated to complete the example task was 360 minutes, six times that normally required.

Calculations of times were made in a similar manner for all the tasks in Tables 2-14, except for those mentioned earlier (i.e., Quartermaster Units and TOW Crew, Tables 12 and 8a, respectively).

Examination of Tables 2-14 indicates a significant increase in the time required to perform tasks while in full MOPP, and that a tremendous increase in time can be expected to complete those tasks requiring heavy workloads at high temperatures. During the work period the actual work time may in reality increase due to a decrease in efficiency. The result would be that more rest time would be required. Therefore, the computed times represent a probable minimum amount of time that<sup>27</sup> may be required to accomplish these tasks, and will likely be higher.

It should be noted that the computed times do not take into account staggered or rotated work assignments, or allocating more people to those tasks considered to be especially critical (assuming that a source of additional manpower was available). The times do include a rest period after the final work period to enable personnel to recover so they can perform their next task.

Another point to consider, but which is not reflected in the tables of computed data, is that if it were known that a unit was to be replaced at a specified time, the personnel could work to a point of exhaustion, and not have to regulate their level of work to be able to perform additional tasks later. The data in Table 17 (from FM 21-40)<sup>6</sup> provide guidance toward determining the duration of sustained periods of work before the onset of significant heat casualties.

#### 4. SUMMARY

The program to date can be summarized as follows:

- A search of the literature revealed a scarcity of quantitative data of the type desired. A large portion of the data was of a subjective nature, while most of the quantitative data was based solely upon heat stress with little or no consideration of other factors such as manual dexterity, visual acuity, or psychological factors.
- Partial task (function)/workload information has been compiled for several branches of the Army. Additional and revised data will be incorporated into the program as they become available; quantified test data will replace calculated data as tests are developed and performed.
- Degradation times for these tasks (functions) have been computed by using the best data currently available, viz., the work/rest times presented in Tables 15 and 16 of this report.

This report has described the initial efforts directed toward establishing and developing a data base which can be utilized to generate meaningful and realistic degradation data through computer simulations. Since this effort has not been completed but will be updated and revised in the future, no conclusions have been made at this time.

TABLE 17 - MAXIMUM TIMES (MINUTES) WITH MINIMUM HEAT CASUALTIES. (1)

| MOPP<br>LEVEL | WORK<br>RATE | TEMPERATURE RANGES |                        |                        |                |
|---------------|--------------|--------------------|------------------------|------------------------|----------------|
|               |              | 21°C<br>(70°F)     | 21°-26°C<br>(70°-79°F) | 27°-32°C<br>(80°-89°F) | 33°C<br>(90°F) |
| 1             | Low          | (2)                | (2)                    | (2)                    | (2)            |
|               | Moderate     | (2)                | (2)                    | (2)                    | 100            |
|               | Heavy        | (2)                | (2)                    | 110                    | 50             |
| 2             | Low          | (2)                | (2)                    | (2)                    | (2)            |
|               | Moderate     | (2)                | (2)                    | (2)                    | 65             |
|               | Heavy        | (2)                | 170                    | 65                     | 45             |
| 3             | Low          | (2)                | (2)                    | (2)                    | (2)            |
|               | Moderate     | (2)                | (2)                    | 140                    | 55             |
|               | Heavy        | 200                | 95                     | 55                     | 40             |
| 4             | Low          | (2)                | (2)                    | (2)                    | 80             |
|               | Moderate     | (2)                | 115                    | 65                     | 40             |
|               | Heavy        | 60                 | 50                     | 40                     | 30             |

(1) Data extracted from Table 5-4, page 5-16, FM21-40, C1, dated 14 October 1977 (Reference 8).

(2) Under these conditions, fatigue caused by exertion will probably be the limiting consideration rather than body heat buildup.

## 5. FURTHER EFFORTS/RECOMMENDATIONS

It should be emphasized that the computations presented herein are based upon the best information currently available. This is to say these data should not be considered as final, but only that there is nothing better at this point in time. It is anticipated that where impractical times have been presented, more realistic data will be obtained, either from published reports not yet located or from personnel with first hand knowledge or experience (test/training participants).

Further efforts will continue to be directed toward updating and expanding the data as it becomes available. Times will be revised to reflect more realistic situations. Tasks (functions) will be expanded as more information is collected. Degradation times will be computed where necessary. An updated version of the data contained in this report is planned in approximately 6 months.

To obtain valid data to support this effort the following recommendations are offered:

- Training exercises, field exercises, etc., should be conducted with and without CW protective gear.
- Tests should be conducted to determine the degree of improvement in effectiveness or efficiency as a function of the number of times tasks are performed while in CW protective gear.
- Accurate measurements of such variables as time, accuracy, rate of fire, probability of hit, ability to acquire targets, etc., should be made. Determine the differences in these parameters with and without CW protective gear.
- Data should be acquired for major battlefield systems and weapons (e.g., IFV, CFV, ITV, 60 mm and 81 mm mortars, VIPER, TOW, etc.).
- As much data as possible should be obtained from field commanders and should not reflect "sterile" test conditions. Data should be "honest" and not be that which makes the unit look good.
- Intermediate MOPP levels should be studied in more detail.
- The effect of acclimatization should be studied to determine if training will significantly reduce degradation and if so, by how much. As a corollary, examine the effects of physical conditioning.

- Tests should be conducted in various climates with emphasis on those where a substantial threat exists.
- Cold weather operations should be studied to determine if any degradation occurs from the cold weather clothing by itself, and what effects are produced by wearing CW protective gear in a cold environment.
- Tests should be conducted for extended periods of time (6 hours) to determine the extent of degradation as a function of time.
- Tests should be conducted to provide data for situations in which personnel are fresh (rested) and fatigued, with and without protective ensembles.
- Where necessary, a series of "mini-tests" should be designed to provide empirical data for inclusion in this program. Such tests might be performed by the US Army Combat Developments Experimentation Command under the direction of HQ TRADOC.

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