REPORTING NUCLEAR DETONATIONS,

BIOLOGICAL AND CHEMICAL ATTACKS,

AND PREDICTING AND WARNING

OF ASSOCIATED HAZARDS

AND HAZARD AREAS

(OPERATORS MANUAL)

ATP-45 (C)

0410LP1049081

January 2006

PUBLICATION NOTICE

ROUTING

1. ATP-45(C), REPORTING NUCLEAR DETONATIONS, BIOLOGICAL AND CHEMICAL ATTACKS, AND PREDICTING AND WARNING OF ASSOCIATED HAZARDS AND HAZARD AREAS (OPERATORS MANUAL), is available in the Navy Warfare Library. It is effective on receipt.

2. Document delineates the prescribed nuclear, biological and chemical (NBC) procedures to be followed by the Land, Air and Naval forces relevant to:

   a. Reporting of all nuclear detonations and of enemy biological or chemical attacks and resulting contamination. Reporting of NBC releases other than attacks (ROTA).

   b. Predicting and warning of hazard areas from NBC attacks and from ROTA.

   c. Evaluation of NBC information and the influence of NBC incidents on operations.

   d. Interchange of reports quoted in a., b. and c. above between NATO forces and national military and civil authorities and agencies.

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NORTH ATLANTIC TREATY ORGANIZATION

NATO STANDARDIZATION AGENCY (NSA)

NATO LETTER OF PROMULGATION

December 2005

1. ATP-45(C) - REPORTING NUCLEAR DETONATIONS, BIOLOGICAL AND CHEMICAL ATTACKS, AND PREDICTING AND WARNING OF ASSOCIATED HAZARDS AND HAZARD AREAS (OPERATOR'S MANUAL) is a NATO UNCLASSIFIED publication. The agreement of interested nations to use this publication is recorded in STANAG 2103.

2. ATP-45(C) is effective on a date to be promulgated by the NSA. When made effective it shall supersede ATP-45(B) and MTP-45 (B), which shall be destroyed in accordance with the local procedures for the destruction of documents.

J. MAJ
Brigadier General, POL (A)
Director, NSA

RECORD OF RESERVATIONS BY NATIONS

CHAPTER	RECORD OF RESERVATIONS BY NATIONS
GENERAL	BEL, BGR, NOR, POL
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NATION	RESERVATIONS
BEL	As regards the AF units which are not yet equipped with the appropriate computer resources, implementation of the parts of the STANAG implying such resources will occur gradually, as these Mat will be acquired or put into service.
BGR	The Bulgarian Armed Forces will not apply this part of the STANAG which is related to the biological weapon-its buying, applying and examination of the technical methods for biological reconnaissance and taking of samples.
NOR	In Norway, the prediction of hazards area will mainly be based on local weather information.
POL	Messages related to biological attacks will not be transmitted due to lack of biological detectors.

RECORD OF CHANGES

Change no.	**Effective date**	**Date entered**	**Signature, Rank and Name of Command**

DEPARTMENT OF THE NAVY
NAVY WARFARE DEVELOPMENT COMMAND
686 CUSHING ROAD
NEWPORT RI 02841-1207

January 2006

U.S. LETTER OF PROMULGATION

1. ATP-45(C), REPORTING NUCLEAR DETONATIONS, BIOLOGICAL AND CHEMICAL ATTACKS, AND PREDICTING AND WARNING OF ASSOCIATED HAZARDS AND HAZARD AREAS (OPERATORS MANUAL), is NATO-UNCLASSIFIED. Handle and store in accordance with OPNAVINST C5510.101D and USAAN INST 1-69.

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3. SECNAVINST 5510.31 provides procedures for disclosing this publication or portions thereof to foreign governments or international organizations.

JOHN M. KELLY

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CHAPTER 1

NBC WARNING AND REPORTING

0101. Purpose of ATP-45

1. The purpose of this publication is to prescribe the nuclear, biological and chemical (NBC) procedures to be followed by the Land, Air and Naval forces for the:

a. Reporting of all nuclear detonations and of enemy biological or chemical attacks and resulting contamination. Reporting of NBC releases other than attack (ROTA).

b. Predicting and warning of hazard areas from NBC attacks and from ROTA.

c. Evaluation of NBC information and the influence of NBC incidents on operations.

d. Interchange of reports, quoted in a. b. and c. above, between NATO forces and national military and civil authorities and agencies.

0102. Aim

1. The aim of Chapter 1 is to describe NBC warning and reporting procedures.

0103. General

1. NBC attacks, ROTA, and resulting contamination can have a significant effect on any military operation, be it on land, in air or at sea, and a decisive influence on a commander's decisions and estimates.

2. In order to enable commanders at all levels to assess the impact of NBC on plans and decisions, they must be provided with timely, accurate and evaluated information on these NBC incidents.

3. Collection, evaluation and exchange of information on NBC incidents form an extremely important part of NBC defence.

4. To ensure timely provision of the most accurate data on enemy NBC incidents and the resulting hazard areas, a NBC warning and reporting capability is required.

5. It is the responsibility of commanders at all levels that plans take into account NBC defence and that directives and Standing Operating Procedures (SOPs) are available and that these fully meet the requirements of this ATP and their respective commands.

0104. NBC Warning and Reporting Areas

1. In order to organise reporting and define responsibilities, the following areas and zones will be established:

- **Nuclear, Biological, Chemical Area of Observation**, which is a geographical area consisting of several nuclear, biological, chemical zones of observation, normally equal to a country. Large countries may be divided into more nuclear, biological, chemical areas of observation. When operating in areas where the nuclear, biological, chemical area of observation is not defined beforehand, the area must be defined and agreed to by the involved commands.

- **Nuclear, Biological, Chemical Zone of Observation**, which is a geographical area which defines the responsibility for collecting and reporting information on enemy or unidentified nuclear detonations, biological or chemical attacks, nuclear, biological and chemical releases other than attacks, and resulting contamination. Nuclear, biological, chemical zones of observations must cover the geographical area defined by a nuclear, biological area of observation.

0105. NBC Warning and Reporting Centres

1. Inside these areas and zones, the following NBC functions will be established:

- Source Level.
- NBC Sub Collection Centres (NBC SCC).
- NBC Collection Centres (NBC CC).
- NBC Zone Control Centres (NBC ZCC).
- NBC Area Control Centres (NBC ACC).

2. The NBC warning and reporting functions and responsibilities should not be confused with the normal chain of command. The exchange of NBC information will of course follow the chain of command, but neighbouring units are to make arrangements for mutual exchange of NBC information through lateral lines of communications and directives to this effect should be contained in command SOPs. The mutual exchange of NBC information through lateral lines of communications should be executed at the lowest possible level.

SECTION I - FUNCTIONS AND RESPONSIBILITIES

0106. Functions

1. NBC Warning and Reporting Centres (NBC WRC) must be established at all levels of command. The type of NBC WRC will depend on the unit role and its organisation:

a. **National**
NBC Area Control Centres (NBC ACC) and NBC Zone Control Centres (NBC ZCC) will be established at national commands. Each NATO nation will normally have at least one NBC Area of Observation, with the national border lines as boundaries. In water areas, of common interest (i.e. English Channel) the middle line is defined as the borderline. The national authorities must appoint an appropriate command(s) to be the NBC Area Control Centre for that designated area of observation. Each area of observation is sub-divided into Zones of Observation, and appropriate commands must be appointed to assume responsibilities as NBC ZCCs.

b. **NATO Commands**
Normally, NATO Commands will not establish NBC ACCs and NBC ZCCs, as these are territorially dependent. The senior NBC Collection Centre (NBC CC) in Out of Area Operations may assume the duties of the Area Control Centre (NBC ACC). In this case, the responsibilities of a NBC ACC are given to a NATO command. NATO units may be engaged in operations, e.g. under the United Nations, where national interests may create a dual chain of information resulting in a reporting requirement to both NATO and national authorities.

c. **Other Commands**
At all NATO and subordinate National Commands, NBC CCs or NBC SCCs must be established down to at least Brigade level, in accordance with national directives.

0107. Source Level

1. NBC observation posts, survey and reconnaissance teams, sites, formations, units and sub units, or any other agency below zone control centre, collection centre or sub collection centre, fall into this category.

2. All source level elements must have an appropriate number of personnel trained and qualified to perform efficiently and rapidly the tasks listed below:

a. Report the initial enemy use of NBC weapons by the most expeditious means available in accordance with directives and SOPs (NBC 1).

b. Report immediately any NBC incident and subsequent data to the respective NBC Centre (NBC 1/4).

c. Disseminate timely warnings of predicted NBC hazard areas to enable forces to increase their NBC state of readiness, to conduct monitoring and to prepare for reconnaissance survey and decontamination (NBC 3).

d. Report detection data, monitoring, reconnaissance and survey results to the respective NBC Centre (NBC 4).

e. Submit detailed information on NBC and ROTA events on request (NBC 6).

0108. NBC Collection or Sub Collection Centres Responsibilities

1. The NBC Collection Centre (NBC CC) or NBC Sub Collection Centre (NBC SCC) is responsible for the receipt, consolidation and evaluation of reports of NBC attacks, ROTA, and the resultant contamination within the area of operation for the unit at which the centre is established. Furthermore, the agency is responsible for the production and dissemination of appropriate reports and warnings in accordance with SOPs, including exchange of information with adjacent centres.

2. NBC SCC may be established below NBC Collection Centres where the organisation and the chain of command require a sub division on NBC centre levels. The establishment of SCCs enables commanders to define organisation and warning and reporting responsibilities allocated to a certain level.

3. The NBC CC or NBC SCC will execute the tasks with regard to their area of operation for such NBC incidents, which have or may have influence on their unit or sub units' operations. NBC reports generated by NBC CC or NBC SCC will normally be indicated in set ALFA (Local Strike Serial Number) field 2 (see Annex B).

4. All NBC SCCs or NBC CCs must therefore have an appropriate number of personnel equipped, trained and qualified to perform efficiently and rapidly the following tasks:

a. Report the initial enemy use of NBC weapons by the most expeditious means available in accordance with directives and SOPs (NBC 1).

b. Clarify, consolidate and evaluate NBC incident data reported from source level or from other NBC centres or agencies (NBC 1, NBC 2 and NBC 4).

c. Calculate detailed fallout prediction, biological hazard areas, chemical hazard areas and ROTA hazard areas including recalculations as a result of significant weather changes. Pass the appropriate warnings to units likely to be affected (NBC 3).

d. Direct survey efforts within their area of operations.

e. Analyse survey and monitoring results and pass information on the actual contaminated areas to units likely to be affected (NBC 4 and NBC 5).

f. Request and provide detailed information on NBC or ROTA events as directed (NBC 6).

g. Exchange NBC information with appropriate national military and civilian authorities as arranged by directives and SOPs.

h. Naval NBC agencies provide information to merchant shipping on predicted or actual radiological contamination (MERWARN NBC Effective Downwind Message (EDM) and MERWARN NBC 3).

0109. NBC Area Control Centre and Zone Control Centre Responsibilities

1. NBC Zone Control Centres (NBC ZCC) may be established at national land or naval commands, at territorial commands, or lower levels of commands.

2. The NBC ZCC is responsible for the receipt, consolidation and evaluation of reports of NBC attacks, and NBC ROTA, and the resultant contamination within the zone of observation. Furthermore the NBC ZCC is responsible for the production and dissemination of appropriate warnings and reports in accordance with SOPs, including exchange of information with adjacent zones. NBC reports generated by a NBC ZCC will normally be indicated in set ALFA (Local Strike Serial Number) in field 2. (See Annex B).

3. The NBC ACC is responsible for coordination of all activities of NBC Centres in a given area of observation. The NBC ACC is responsible for:

a. The final deconfliction and correlation of reports, identification, clarification, consolidation.

b. Evaluation of enemy or unidentified NBC attacks and ROTA in the area.

c. The exchange of information with national military and civilian authorities.

d. Tactical evaluations of the NBC situation in its own and adjacent areas.

NBC reports generated by a NBC ACC will normally be indicated in set ALFA (Official Strike Serial Number) in field 1 and 2 (See Annex B).

4. The NBC ACC or NBC ZCC will execute the tasks with regard to the NBC Area of Observation or Zone of Observation and to all NBC incidents within that area or zone.

5. When operating in areas where the NBC Area of Observation and the Zone of Observation are not defined beforehand, the NBC ACC and NBC ZCC responsibilities must be assigned to suitable agencies, and appropriate SOPs must be established, agreed to and exercised by the involved commands.

6. NBC ACCs and NBC ZCCs must have an appropriate number of personnel equipped, trained and qualified to perform efficiently and rapidly the tasks listed below:

a. Report the enemy use of NBC weapons by the most expeditious means available in accordance with directives and SOPs (NBC 1).

b. Clarify, correlate, consolidate and evaluate NBC incidents data reported from other centres or agencies (NBC 1, NBC 2 and NBC 4).

c. Transmit promptly NBC warnings to adjacent HQ's or agencies when predicted hazard areas extend beyond their own area of responsibility (NBC 3).

d. Exchange NBC information with appropriate national military and civilian authorities as arranged by directives and SOPs.

e. Organise and coordinate the NBC warning and reporting system within their area or zone of observation.

f. Submit reports to higher HQ's and adjacent agencies as required.

7. NBC ACCs must furthermore be able to make final filtering and correlation of all NBC incidents in the Area of Observation.

8. The NBC ACC may be responsible for the organisation and the implementation of sampling and identification of biological and chemical agents in accordance with relevant Allied Engineer Publications (AEP).

SECTION II - COORDINATION

0110. Importance of Coordination

1. For proper contingency planning at all levels of the NBC warning and reporting organisation, co-ordination is of importance.

2. This planning has to aim at providing NBC information rapidly where it is required and at reducing duplication of reports to an acceptable level.

111. Overlap and Duplication

1. For functional and operational reasons, the areas of responsibility of NATO Army, Air and Navy forces overlap. Also the areas of responsibility of Territorial Army, civil defence and forces not assigned to NATO may overlap or even be identical.

2. Consequently, NBC reports will inevitably be duplicated, particularly in the case of a nuclear detonation.

3. Therefore, commanders at all levels are to ensure that their plans are fully coordinated with all neighbouring NBC centres in order to avoid duplication of reports by correlation and to ensure rapid and efficient exchange of useful NBC information.

4. NBC Warning and Reporting plans must be available and state the requirement for NBC reports to be submitted between units.

0112. Clarification and Correlation

1. It is mandatory that NBC reporting manuals and SOP regulations include procedures for clarification and correlation to cope with duplicate reports received in a NBC centre.

2. Reporting manuals and regulations must also provide for discrimination between enemy and NATO strikes, as NATO units, which are not warned of a NATO strike (STANAG 2104), may be expected to report the detonation, assuming it to be an enemy strike.

3. To obtain a final filtering and correlation for all NBC incidents, this responsibility must be allocated to a particular agency for a particular area. NBC SOPs must therefore define NBC Areas of Observation and NBC Zones of Observations.

0113. Area HQ's and Maritime HQ's

1. Area HQ's and maritime HQ's are to maintain direct communication with regional HQ's and/or appropriate units of the national civil defence organisations concerned.

2. Information on nuclear bursts on shore targets and predictions of the land areas, which will probably be affected by fallout, is to be passed to area HQ's and/or relevant NBC Centres.

3. In the same manner, information on NBC and ROTA hazards is to be exchanged between area HQ's and maritime HQ's.

0114. Civil/Military Cooperation

1. Cooperation and coordination between the NATO NBC warning and reporting system and the national military and civil systems is an important strengthening factor to the common defence effort of NATO.

2. The details of information exchange depend upon national policy and the structure of the national forces and the civil defence organisation.

3. Commanders must delegate authority to the appropriate levels of command for negotiating agreements and arrangements with corresponding national armed forces and/or civil defence authorities. Warning information should be exchanged at the lowest level possible.

SECTION III - NBC MESSAGE TYPES

0115. Standard NBC Message Formats

1. Standard message formats are used by all services for reporting NBC attacks and ROTA events and predicted or actual hazard areas following such attacks (The different units of measurement (see Annex C) used by land, air and sea forces must be taken into account).

2. The standard NBC 1 - 6 message formats are described in detail in Chapter 2. The NBC SITREP is used in accordance with local directives to describe the NBC situation in a free text format. The Automated Data Processing (ADP) requirements for the NBC SITREP are listed in Annex B.

0116. Meteorological Data

1. Current meteorological data are a vital prerequisite for radiological fallout and biological, chemical and ROTA downwind hazard prediction.

2. The meteorological service will collect data and distribute the messages described below. Meteorological data are transmitted as a NBC Wind Report.

a. **NBC Basic Wind Report (NBC BWR)**
A NBC Basic Wind Report is either a NBC Basic Wind Message (NBC BWM) or a NBC Basic Wind Forecast (NBC BWF) These are messages containing basic meteorological data to be used for fallout prediction (see Chapter 6).
The NBC BWR is an ADP formatted message used to accommodate either the NBC BWM or the NBC BWF when transmitted (see Annex B and AEP-45, Appendix D-9).

b. **NBC Effective Downwind Report (NBC EDR)**
A NBC Effective Downwind Report is either a NBC Effective Downwind Message (NBC EDM) or a NBC Effective Downwind Forecast (NBC EDF). These are messages containing information on downwind speed and downwind direction (towards which the wind is blowing) for each of seven pre-selected weapon yields (see Chapter 7).
The NBC EDR is an ADP formatted message used to accommodate either the NBC EDM or the NBC EDF message when transmitted (see Annex B and AEP-45, Appendix D-11).

c. **NBC Chemical (Biological) Downwind Report (NBC CDR)**
A NBC Chemical Downwind Report is either a NBC Chemical Downwind Message (NBC CDM) or a NBC Chemical Downwind Forecast (NBC CDF). These are messages containing basic meteorological information for predicting biological aerosol (see Chapter 9) and chemical vapour hazard areas (see Chapter 12).

The NBC CDR is an ADP formatted message used to accommodate either the NBC CDM or the NBC CDF message when transmitted (see Annex B and AEP-45, Appendix D-11).

3. Directives and SOPs are to provide for the proper distribution of this data.

0117. MERWARN Messages

1. A simplified fallout warning system is established for broadcasting, via MERCOMMS or coastal radio stations, warnings of fallout endangering merchant shipping, - the MERWARN SYSTEM. (See Chapter 11).

2. The MERWARN system calls for the origination, by naval authorities, of the following five types of messages:

a. MERWARN NBC EDM. A message containing information on downwind speed and downwind direction for a 1 megaton (1000 KT) nuclear detonation.

b. MERWARN NBC 3 NUC. A message used for passing immediate warning of expected radiological contamination.

c. MERWARN NBC Chemical Downwind Message (MERWARN NBC CDM). A message which will allow merchant ships' masters to plot the predicted hazard area following a chemical attack.

d. MERWARN NBC 3 CHEM. A message used to promulgate the hazard resulting from a particular ch emical attack.

e. MERWARN DIVERSION ORDER. A message, which gives evasive routing instructions of a more general nature, to merchant ships proceeding independently.

CHAPTER 2

NBC MESSAGES, STANDARD MESSAGE FORMATS

0201. Aim

1. The aim of this chapter is to describe in detail the purpose and the contents of each of the six standard NBC messages, these message formats include the set NBCEVENT that describes the type of NBC message.

a. **Common Message Heading**.

(1) NBC Reports.
NBCEVENT = NUC, BIO, CHEM, ROTA, WARN or UNK.

(2) NBC Weather Reports.
NBCEVENT = BWM, BWF, EDM, EDF, CDM or CDF.

b. **NBC Messages**.

(1) NBC 1 Observer's report, giving basic data.

(2) NBC 2 Report for passing the evaluated data from collected NBC 1 reports.

(3) NBC 3 Report for immediate warning of predicted contamination and hazard areas.

(4) NBC 4 Report for reporting detection data and passing monitoring and survey results. This report is used for two cases. Case one; used if an attack is not observed, and the first indication of contamination is by detection. Case two, used to report measured contamination as a part of a survey or monitoring team.

(5) NBC 5 Report for passing information on areas of actual contamination. This report can include areas of possible contamination, but only if actual contamination coordinates are included in the report.

(6) NBC 6 Report for passing detailed information on NBC events.

c. **NBCSITREP**.
The NBCSITREP is a free text message. The national authority or command gives rules for contents. Examples are to be given in national or NATO directives.

0202. Automatic Data Processing (ADP)

1. For the development of machine processed data the procedures of AEP-45 will be used. It is noted that all automated message transmissions should use latitude and longitude in degrees, minutes or degrees, minutes and seconds.

2. An ADP system requires information to be entered in specific ways to enable processing to be completed. However, the results of machine processed data must be compatible with those manually processed when using nomograms, tables and charts.

3. If unit SOPs require the man-readable output from ADP systems to be identical to the manual system, appropriate software must be developed.

0203. Position Referencing

1. When using NBC standard message formats locations must be identified in WGS84 by geographical coordinates (LAT/LONG), standard Universal Transverse Mercator (UTM) grid coordinates, in accordance with the Military Grid Reference System (MGRS) or by geographical name.

2. SOPs or software must provide for any situation where the use of differing systems may cause confusion.

0204. Classification and Precedence

1. Unless the NBC message contains specific operational information, e.g. effects on troops, all such messages should be unclassified.

2. NBC 1 messages reporting the FIRST enemy use of NBC weapons (first use of nuclear weapons, first use of biological weapons and first use of chemical weapons) must be given precedence FLASH (Z).

3. All other messages should be given a precedence, which reflects the operational value of the contents. Normally IMMEDIATE (O) would be appropriate.

4. Once an NBC event occurs, the number of NBC messages will be substantial. NBC staffs must prepare their SOPs carefully in order to avoid an unnecessary load on the communication systems.

Note: When a NBC 3 NUC is used for friendly strikes, the information contained in sets DELTA and FOXTROT, will not be sent in plain language, unless the time of initiating the warning message is such, that no compromise of security is involved, and unless its passage in plain language is essential to troop safety. Only coding systems, which meet NATO security criteria, are to be used.

0205. Meaning of Sets used in all NBC Reports

1. Each type of NBC message is comprised of a sequence of sets and has a unique identifier. The meaning of the sets is described below. Each set contains a sequence of fields. The format for the fields, allowable entries and conditionalities are explained in Annexes B, C and D.

List of Sets for NBC Reports

SET:	MEANING:
ALFA	Strike Serial Number
BRAVO	Location of observer and direction of attack or event
CHARLIE	Date-time group of report or observation and end of event
DELTA	Date-time group of attack or detonation and attack end
FOXTROT	Location of attack or event
GENTEXT	General text
GOLF	Delivery and quantity information
HOTEL	Type of nuclear burst
INDIA	Release information on biological/chemical agent attacks or ROTA events
JULIET	Flash-To-Bang Time in Seconds
KILO	Crater description
LIMA	Nuclear burst angular cloud width at H+5 minutes
MIKE	Stabilised cloud measurement at H+10 minutes
MIKER	Description and status of ROTA event
NOVEMBER	Estimated nuclear yield in kilotons
OSCAR	Reference date-time group for estimated contour lines
PAPAA	Predicted attack/release and hazard area
PAPAB	Detailed fallout hazard prediction parameters
PAPAC	Radar determined external contour of radioactive cloud
PAPAD	Radar determined downwind direction of radioactive cloud
PAPAX	Hazard area location for weather period
QUEBEC	Location of reading/sample/detection and type of sample/detection
ROMEO	Level of contamination, dose rate trend & decay rate trend
SIERRA	Date-time group of reading or initial detection of contamination
TANGO	Terrain/topography and vegetation description
WHISKEY	Sensor information
XRAYA	Actual contour information
XRAYB	Predicted contour information
YANKEE	Downwind direction and downwind speed
ZULU	Actual weather conditions

0206. Examples of NBC Reports

1. Examples of NBC 1 to NBC 6 messages are given on the following pages. Users of NBC messages are not restricted to the use of sets shown in the examples. The "Cond" column in the examples shows that each set is either operationally determined (O), conditional (C) or mandatory (M) for each message type (see Annex D, D02). Operationally determined sets listed may be added or deleted at the user discretion. For example, higher level NBC centres could add sets ALFA to NBC 1 reports to correlate them to a strike.

2. When using ADP systems the sets must follow the Occurrence Matrix shown in Annex D.

3. NBC reports start with a common message heading consisting of NBC report number (1-6), and event (NUC, BIO, CHEM, ROTA or unknown). Note that the sets in the BIO and CHEM messages are the same; therefore, the examples appear as BIO or CHEM.

NBC 1

Purpose: Observer's report, giving basic data

NUC			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	O	
BRAVO	Location of Observer and Direction of Attack or Event	M	BRAVO/32UNB062634/2500MLG//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	M	DELTA/201405ZSEP1997//
FOXTROT	Location of Attack or Event	O	FOXTROT/32UNB058640/EE//
GOLF	Delivery and Quantity Information	M	GOLF/SUS/AIR/1/BOM/1//
HOTEL	Type of Nuclear Burst	M	HOTEL/SURF//
JULIET	Flash-to-Bang Time in seconds	O	JULIET/57//
LIMA	Nuclear Burst Angular Cloud Width at H+5 Minutes	O	LIMA/18DGT//
MIKE	Stabilized Cloud Measurement at H+10 Minutes	O	MIKE/TOP/33DGT/9KM//
PAPAC	Radar Determined External Contour of Radioactive Cloud	O	
PAPAD	Radar Determined Downwind Direction of Radioactive Cloud	O	
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

NBC 1 (continued)

Purpose: Observer's report, giving basic data

CHEM			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	C	
BRAVO	Location of Observer and Direction of Attack or Event	M	BRAVO/32UNB062634/2500MLG//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	M	DELTA/201405ZSEP1997/ 201420ZSEP1997//
FOXTROT	Location of Attack or Event	O	FOXTROT/32UNB058640/EE//
GOLF	Delivery and Quantity Information	M	GOLF/OBS/AIR/1/BML/-//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/AIR/NERV/P/ACD//
TANGO	Terrain/Topography and Vegetation Description	M	TANGO/FLAT/URBAN//
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

ROTA			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	O	
BRAVO	Location of Observer and Direction of Attack or Event	M	BRAVO/32UNB062634/2500MLG//
CHARLIE	Date-Time-Group of Report or Observation and End of Event	M	CHARLIE/281530ZSEP1997//
FOXTROT	Location of Attack or Event	O	FOXTROT/32UNB058640/EE//
GOLF	Delivery and Quantity Information	M	GOLF/SUS/TPT/1/TNK/SML//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/SURF/2978/-/ARD//
MIKER	Description and Status	O	MIKER/LEAK/CONT//
TANGO	Terrain/Topography and Vegetation Description	M	TANGO/URBAN/URBAN//
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

NBC 2

Purpose: Report used for passing evaluated data.

NUC			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	M	ALFA/UK/A234/001/N/55//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	M	DELTA/201405ZSEP1997//
FOXTROT	Location of Attack or Event	M	FOXTROT/32UNB058640/EE//
GOLF	Delivery and Quantity Information	M	GOLF/SUS/AIR/1/BOM/1//
HOTEL	Type of Nuclear Burst	M	HOTEL/SURF//
NOVEMBER	Estimated Nuclear Yield in KT	M	NOVEMBER/UNK//
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

BIO			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	M	ALFA/UK/A234/001/B//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	M	DELTA/201405ZSEP1997/ 201420ZSEP1997//
FOXTROT	Location of Attack or Event	M	FOXTROT/32UNB058640/EE//
GOLF	Delivery and Quantity Information	M	GOLF/OBS/AIR/1/BML/-//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/AIR/BIO/-/DET//
TANGO	Terrain/Topography and Vegetation Description	M	TANGO/FLAT/URBAN//
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

NBC 2 (continued)

Purpose: Report used for passing evaluated data.

ROTA			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	M	ALFA/US/WEP/001/RN//
CHARLIE	Date-Time-Group of Report /Observation and Event End	M	CHARLIE/281530ZSEP1997/ 281545ZSEP1997//
FOXTROT	Location of Attack or Event	M	FOXTROT/32UNB058640/EE//
GOLF	Delivery and Quantity Information	M	GOLF/SUS/TPT/1/TNK/1//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/SURF/2978/-/ARD//
MIKER	Description and Status	M	MIKER/LEAK/CONT//
TANGO	Terrain/Topography and Vegetation Description	M	TANGO/URBAN/URBAN//
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

NBC 3

Purpose: Report used for passing immediate warning of predicted contamination and hazard areas

NUC			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	M	ALFA/UK/A234/001/N//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	M	DELTA/201405ZSEP1997//
FOXTROT	Location of Attack or Event	M	FOXTROT/32UNB058640/EE//
GOLF	Delivery and Quantity Information	O	GOLF/SUS/AIR/1/BOM/4//
HOTEL	Type of Nuclear Burst	O	HOTEL/SURF//
NOVEMBER	Estimated Nuclear Yield in KT	O	NOVEMBER/50//
PAPAB	Detailed Fallout Hazard Prediction Parameters	M	PAPAB/019KPH/33KM/5KM/ 272DGT/312DGT//
PAPAC	Radar Determined External Contour of Radioactive Cloud	O	PAPAC/32VNJ456280/32VNJ456119/ 32VNJ556182/32VNJ576200/ 32VNJ566217/32VNJ456280//
PAPAD	Radar Determined Downwind Direction of Radioactive Cloud	O	PAPAD/030DGT//
XRAYB**	Predicted Contour Information	C	
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

CHEM			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	M	ALFA/UK/A234/001/C//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	M	DELTA/201405ZSEP1997/ 201420ZSEP1997//
FOXTROT	Location of Attack or Event	M	FOXTROT/32UNB058640/EE//
GOLF	Delivery and Quantity Information	O	GOLF/OBS/AIR/1/BML/-//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/AIR/NERV/P/ACD//
PAPAA	Predicted Attack/Release and Hazard Area	M	PAPAA/1KM/3-10DAY/10KM/ 2-6DAY//
PAPAX*	Hazard Area Location for Weather Period	M	PAPAX/201600ZSEP1997/ 32VNJ456280/32VNJ456119/ 32VNJ576200/32VNJ566217/ 32VNJ456280//
XRAYB**	Predicted Contour Information	C	
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	GENTEXT/NBCINFO/RECALCULATION BASED ON WEATHER CHANGE//

***** Set is repeatable up to 3 times in order to describe three possible hazard areas corresponding to the time periods from the CDM. A hazard area for a following time period will always include the previous hazard area.

** Set is repeatable up to 50 times to represent multiple contours

NBC 3 (continued)

Purpose: Report used for passing immediate warning of predicted contamination and hazard areas

ROTA			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	M	ALFA/US/WEP/001/RN//
CHARLIE	Date-Time-Group of Report /Observation and Event End	M	CHARLIE/281530ZSEP1997//
FOXTROT	Location of Attack or Event	M	FOXTROT/32UNB058640/EE//
GOLF	Delivery and Quantity Information	O	GOLF/SUS/TPT/1/TNK/1//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/SURF/2978/-/ARD//
PAPAA	Predicted Attack/Release and Hazard Area	M	PAPAA/1000M/-/5KM/-//
PAPAX*	Hazard Area Location for Weather Period	M	PAPAX/081200ZSEP1997/ 32VNJ456280/32VNJ456119/ 32VNJ576200/32VNJ566217/ 32VNJ456280//
XRAYB**	Predicted Contour Information	C	
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

* Set is repeatable up to 3 times in order to describe three possible hazard areas corresponding to the time periods from the CDM. A hazard area for a following time period will always include the previous hazard area.

** Set is repeatable up to 50 times to represent multiple contours

NBC 4

Purpose: Report used for reporting detection data and passing monitoring and survey results

NUC			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond**	**Example**
ALFA	Strike Serial Number	O	ALFA/UK/A234/001/N//
KILO	Crater Description	O	KILO/UNK//
QUEBEC*	Location of Reading/Sample/Detection and Type of Sample/Detection	M	QUEBEC/32VNJ481203/GAMMA/-//
ROMEO*	Level of Contamination, Dose Rate Trend and Decay Rate Trend	M	ROMEO/7CGH/DECR/DN//
SIERRA*	Date-Time-Group of Reading or Initial Detection of Contamination	M	SIERRA/202300ZSEP1997//
WHISKEY	Sensor Information	O	WHISKEY/POS/POS/YES/HIGH//
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

* Sets QUEBEC, ROMEO, SIERRA and TANGO are a segment. This segment is mandatory. Sets/segments are repeatable up to 20 times in order to describe multiple detection, monitoring or survey points.

NBC 4 (continued)

Purpose: Report used for reporting detection data and passing monitoring and survey results

CHEM			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond**	**Example**
ALFA	Strike Serial Number	O	ALFA/UK/A234/001/C//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/UNK/NERV//
QUEBEC*	Location of Reading/Sample/Detection and Type of Sample/Detection	M	QUEBEC/32VNJ481203/-/DET//
ROMEO*	Level of Contamination, Dose Rate Trend and Decay Rate Trend	O	ROMEO/20PPM//
SIERRA*	Date-Time-Group of Reading or Initial Detection of Contamination	M	SIERRA/202300ZSEP1997//
TANGO*	Terrain/Topography and Vegetation Description	M	TANGO/FLAT/URBAN//
WHISKEY	Sensor Information	O	WHISKEY/POS/POS/NO/MED//
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

* Sets QUEBEC, ROMEO, SIERRA and TANGO are a segment. With exclusion of set ROMEO, this segment is mandatory. Sets/segments are repeatable up to 20 times in order to describe multiple detection, monitoring or survey points.

ROTA			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond**	**Example**
ALFA	Strike Serial Number	O	ALFA/US/WEP/001/RN//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/SURF/2978/-/SPEC//
QUEBEC*	Location of Reading/Sample/Detection and Type of Sample/Detection	M	QUEBEC/32VNJ481203/GAMMA/-//
ROMEO*	Level of Contamination, Dose Rate Trend and Decay Rate Trend	O	ROMEO/7CGH/DECR/DF//
SIERRA*	Date-Time-Group of Reading or Initial Detection of Contamination	M	SIERRA/202300ZSEP1997//
TANGO*	Terrain/Topography and Vegetation Description	M	TANGO/URBAN/URBAN//
WHISKEY	Sensor Information	O	WHISKEY/-/POS/NO/HIGH//
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

* Sets QUEBEC, ROMEO, SIERRA and TANGO are a segment. With exclusion of set ROMEO, this segment is mandatory. Sets/segments are repeatable up to 20 times in order to describe multiple detection, monitoring or survey points.

NBC 5

Purpose: Report used for passing information on areas of actual contamination.

NUC			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	O	ALFA/UK/A234/001/N//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	O	DELTA/201405ZSEP1997//
OSCAR	Reference Date-Time-Group for Estimated Contour Lines	M	OSCAR/201505ZSEP1997//
XRAYA*	Actual Contour Information	M	XRAYA/5CGH/32UND620475/ 32UND662522/32UND883583/ 32UND830422/32UND620475//
XRAYB*	Predicted Contour Information	O	XRAYB/75/100CGH/32UND621476/ 32UND621477/32UND622477/ 32UND622476/32UND621476//
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

CHEM			
Common Message Heading followed by the following sets:			
Set	Description	Cond.	Example
ALFA	Strike Serial Number	O	ALFA/UK/A234/001/C//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	O	DELTA/201405ZSEP1997//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/AIR/NERV/P/ACD//
OSCAR	Reference Date-Time-Group for Estimated Contour Lines	M	OSCAR/201505ZSEP1997//
XRAYA*	Actual Contour Information	M	XRAYA/LCT50/32VNJ575203/ 32VNJ572211/32VNJ560219/ 32VNJ534218/32VNJ575203//
XRAYB*	Predicted Contour Information	O	
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

* Sets are repeatable up to 50 times to represent multiple contours

NBC 5 (continued)

Purpose: Report used for passing information on areas of actual contamination

ROTA			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	O	ALFA/US/WEP/001/RN//
CHARLIE	Date-Time-Group of Report /Observation and Event end	O	CHARLIE/281530ZSEP1997//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	M	INDIA/SURF/2978/-/SPEC//
OSCAR	Reference Date-Time-Group for Estimated Contour Lines	M	OSCAR/281830ZSEP1997//
XRAYA*	Actual Contour Information	M	XRAYA/0.003CGH/334015N1064010W/ 334020N1064010W/ 334020N1064020W/ 334015N1064020W/ 334015N1064010W//
XRAYB*	Predicted Contour Information	O	
YANKEE	Downwind Direction and Downwind Speed	O	YANKEE/270DGT/015KPH//
ZULU	Actual Weather Conditions	O	ZULU/4/10C/7/5/1//
GENTEXT	General Text	O	

* Sets are repeatable up to 50 times to represent multiple contours

NBC 6

Purpose: Report used for passing detailed information on NUC, BIO, CHEM or ROTA events.

NUC			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	O	ALFA/UK/A234/001/N//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	O	DELTA/201405ZSEP1997//
FOXTROT	Location of Attack and Qualifier	O	FOXTROT/32UNB058640/EE//
QUEBEC	Location & Type Reading /Sample /Detection	O	QUEBEC/32VNJ481203/GAMMA/-//
SIERRA	Date-Time-Group of Reading	O	SIERRA/202300ZSEP1997//
GENTEXT	General Text	M	GENTEXT/NBCINFO/WEAPON YIELD ESTIMATED FOR EVALUATION OF COLLATERAL DAMAGE PURPOSES ONLY//

NBC 6 (continued)

Purpose: Report used for passing detailed information on NUC, BIO, CHEM or ROTA events.

CHEM			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	O	ALFA/UK/A234/001/C//
DELTA	Date-Time-Group of Attack or Detonation and Attack End	O	DELTA/201405ZSEP1997/ 201420ZSEP1997//
FOXTROT	Location of Attack and Qualifier	O	FOXTROT/32UNB058640/EE//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	O	INDIA/AIR/NERV/P/ACD//
QUEBEC	Location & Type Reading /Sample /Detection	O	QUEBEC/32VNJ481203/-/DET//
SIERRA	Date-Time-Group of Reading	O	SIERRA/202300ZSEP1997//
GENTEXT	General Text	M	GENTEXT/NBCINFO/SICA LAB REPORT HAS IDENTIFIED THE AGENT AS VX//

ROTA			
Common Message Heading followed by the following sets:			
Set	**Description**	**Cond.**	**Example**
ALFA	Strike Serial Number	O	ALFA/US/WEP/001/RN//
CHARLIE	Date-Time-Group of Report /Observation and Event End	O	CHARLIE/281530ZSEP1997/ 281545ZSEP1997//
FOXTROT	Location of Attack or Event	O	FOXTROT/32UNB058640/EE//
INDIA	Release Information on Biological/Chemical Agent Attacks or ROTA events	O	INDIA/SURF/2978/-/SPEC/-//
QUEBEC	Location & Type Reading /Sample /Detection	O	QUEBEC/32VNJ481203/GAMMA//
SIERRA	Date-Time-Group of Reading	O	SIERRA/282300ZSEP1997//
GENTEXT	General Text	M	GENTEXT/NBCINFO/HOSPITAL VEHICLE CARRYING RADIOACTIVE WASTE OVERTURNED ON ROUTE 25//

CHAPTER 3

NATURE AND IMPORTANCE OF FALLOUT

0301. Nature of Fallout

1. Nuclear detonations produce radioactive clouds, which rise to heights dependent, in principal, upon the energy released, and also on the type of burst. Once the debris is injected into the atmosphere, it is rapidly spread through the atmosphere by diffusive processes, and eventually deposited on the surface.

0302. Categories of Fallout

1. The process of removal of radioactive debris from the atmosphere and its deposition at the surface may be divided into three phases:

a. Immediate - the depositing of heavy debris within half an hour of the burst, which occurs mostly in the area in which physical damage is sustained.

b. Medium range - that which is deposited between half an hour and approximately twenty hours after a nuclear explosion out to the ranges of some hundreds of kilometres from the point of burst in the case of megaton weapons.

c. Long range - the slow removal of very small particles, which may continue for months or even years, particularly after a high yield thermo nuclear explosion. This is diffused and eventually deposited over a very large area of the earth’s surface.

0303. Hazards of Fallout

1. In general, medium range fallout represents the most significant hazard to personnel. The effects of immediate fallout are normally greatly overshadowed by initial radiation, blast and thermal effects in the vicinity of nuclear bursts, and the radiological dose from long-range fallout does not reach tactically significant levels. Medium range fallout can cover an area of several hundred square kilometres and constitutes a definite hazard; it should be avoided or protective measures taken against it. In subsequent paragraphs the term fallout will concern only medium range fallout, unless otherwise specifically stated.

0304. Height of Burst

1. Fallout is of military importance after a nuclear explosion. The extent of the hazards resulting from radioactivity on the ground depends primarily on the height of burst.

0305. High Air Bursts

1. When a nuclear weapon is detonated at a height that precludes damage or casualties to ground targets, such as in an air defence role, neither induced radiation nor fallout of tactical significance occurs.

0306. Low Air Bursts

1. When a nuclear weapon produces damage or casualties on the ground, but the burst is kept above the minimum fallout safe height, only neutron-induced radiation occurs. Neutron induced radiation is relatively limited in area, and changes in tactical plans can normally be made to ensure that it does not grossly interfere with military operations.

0307. Surface Bursts

1. When a surface burst or near surface burst is employed, both neutron induced radiation and fallout result. The fallout pattern can be expected to overlap and overshadow the entire induced radiation pattern.

0308. Subsurface Bursts

1. Subsurface bursts produce induced radiation.

0309. Underwater Bursts

1. The greatest radioactive hazard from an underwater burst is emitted from the base surge. This is a misty, highly radioactive cloud of water droplets (spray), moving rapidly outwards from ground zero, for a distance of 2 to 4 miles.

2. The droplets which make up the visible base surge evaporate, leaving particles and gases in the air as an invisible radioactive base surge, which continues to expand outwards and move in the downwind direction.

3. The length of time for which this invisible base surge remains radioactive depends on the energy yield of the explosion, the burst depth, and the nearness of the sea bottom to the point of burst.

4. As a general rule, it is expected that there will be a considerable hazard from the radioactive base surge within the first 5 to 10 minutes after an underwater explosion and a decreasing hazard for half an hour or more.

5. Where the burst depth is sufficient to prevent the fireball from breaking the surface, almost all energy is dissipated as shock, and the fallout is negligible.

0310. Significance of Fallout

1. The large area contaminated by fallout from large surface bursts poses an operational problem of great importance. Potentially, fallout may extend to greater distances and cause more casualties than any other weapon effect. It exerts an influence on the battlefield for a considerable time after a detonation.

0311. Height of Burst over the Sea

1. Fallout is of importance after a nuclear explosion only where the fireball touches the surface of the sea. A low airburst, surface or shallow subsurface bursts will all produce fallout. A deep underwater burst will not produce fallout, but in all cases a temporary pool of radioactive water will remain in the vicinity of ground zero.

2. Ships should be able to transit ground zero safely approximately four hours after burst. Fallout from a nuclear burst over the sea will tend to be deposited more quickly than that from an equivalent burst over the land. The pattern of fallout will, however, be similar to that from a land burst.

0312. Effects of Fallout on Ships at Sea

1. Ships out to several hundred miles from ground zero may be subject to fallout from surface and some sub-surface bursts. A forecast of the fallout pattern will enable them to take avoiding manoeuvres or preventive measures.

2. Manoeuvres to avoid fallout must be based on the fallout prediction using NBC EDM. Should it be necessary to pass through fallout, wash down or pre-wetting systems (if available) should be activated, shelter stations assumed and passage delayed as long as possible.

3. If these measures are taken, casualties from fallout should be negligible. Ships receiving no warning and remaining within this fallout zone longer than necessary without adopting these preventive measures may sustain serious casualties.

4. Fallout landing on the surface of the water is rapidly diffused and there is very little danger to ships passing through water where deposition has ceased.

Note: The most significant radiation is gamma radiation, which presents a serious personnel hazard because of its range and penetrating power.

5. The biological effects on humans from residual radiation are essentially the same as the effect from initial radiation.

CHAPTER 4

YIELD ESTIMATION

0401. Aim

1. The aim of this chapter is to describe the methods by which it is possible to estimate the yield of a nuclear detonation, based upon measurements and/or parameters reported from observers.

0402. General

1. Estimation of the yield of a nuclear detonation requires observation results as contained in the observers' report (NBC 1 NUC). The observers must report as much of the data as possible, subsequent reports can be sent, as more details become available.

2. The yield of the detonation may be estimated by using the data contained in the sets JULIET, LIMA and MIKE as entrance figures in the nomograms in Annex A, Figures A-I, A-II and A-III.

3. It should be noted that, when the distance from an observer to GZ has been determined, this distance should be used rather than the flash-to-bang time, when using the nomograms in Figure A-I and A-II.

4. The methods will be described in the following paragraphs of this chapter.

   a. Determination of the distance from the observer to Ground Zero (GZ).

   b. Distance from Observer to GZ or Flash-to-Bang Time and Angular Cloud Width (Figure A-I).

   c. Distance from Observer to GZ or Flash-to-Bang Time and Cloud Top and/or Cloud Bottom Angle (Figure A-II) (Ground bursts or unknown only).

   d. Height of stabilised cloud top and/or cloud bottom (Figure A-III) (Ground bursts or unknown only).

   Note: Use of the angular cloud width in para 404 is considered to be better (more accurate) than the methods listed in paras 405 and 406.

0403. Distance from Observer to GZ

1. The procedures in this paragraph can be used to improve the manual calculation of an NBC 2 NUC calculated from the information contained in one or more NBC 1 NUC. In order to gain maximum benefit from this information, it should meet certain requirements.

a. Quality Requirements for Data in NBC 1 NUC Messages.
The quality of information given in a NBC 1 NUC message will determine the quality of the resultant NBC 2 NUC. To obtain the best NBC 2 NUC the following criteria should be followed:

- Flash-to-bang-time. This should be used when only **one** NBC 1 NUC is available.
- Distance of observer to GZ. If the distance is > 50 km then the information should be disregarded when calculating GZ. The observation may still be used to calculate the yield but only if the cloud width is ≥ 4°.
- Directions of observers to GZ. Using the observers position and the reported direction toward GZ (set BRAVO), determine the intersection points of the lines of sight toward GZ between any two observers. If the smallest angle formed at the intersection point by the lines of sight is less than 30° then disregard this intersection point when determining GZ.
- Cloud width angle. If the cloud width angle is measured to be less than 4° or more than 40° then the measurement should be disregarded. A cloud width angle of about 15° is regarded as the most accurate to estimate the weapon yield.
  When using the nomograms in ATP-45, Annex A, the accuracy of the estimated yield will decrease with larger or smaller angles. An automated system takes care of the inaccuracy when the angle is **larger** than 15°. The cloud width angle is a better measurement than cloud top and cloud bottom angles.
- Angle to the cloud bottom/top. If the angle to the cloud bottom/top is measured to be less than 10° or more than 45° then the measurement should be disregarded.

b. The Date Time Group (DTG) in the NBC 1 NUC to be processed simultaneously cannot be used for separating attacks. Observers may not have synchronised time, or several attacks may be reported at the same time. However, for practical reasons NBC 1 NUC should be separated in time clusters which will be calculated separately.

c. Separation of clusters in time groups.

(1) Use all date time groups (DTG) from set DELTA (field one) in the NBC 1 NUC available for calculation.

(2) Plot all reports with the same DTG (+ - 10 min.).
- Use the Observer's Location (set BRAVO, first field) to define the position of the observer.
- Use the Direction of Attack from Observer (set BRAVO, second field) to define the direction of the observation.

(3) Separate the reports in groups which intersect at the same point (within a 1 km diameter circle).

d. The GZ is determined when at least three observer's directions hit the same position (+ - 1000 m). Use only reports which fulfil the requirements in para 403.a.

e. When a GZ has been determined in accordance with para 403.d., measure the distance from each observer to the GZ. Use all reports which are within the time frame and intersects with the 1 km circle even though some of these reports have not been used for the GZ calculation. For further calculations of the weapon yield the subsequent procedures should be followed using the measured distance only.

f. The calculation of GZ, based on one report only, is regarded as a very unsatisfactory method and is not considered acceptable. However, after validation of the calculated GZ a single NBC 1 NUC may be left. Use the GZ from the NBC 1 NUC. If no further NBC 1 NUC can be obtained, the operator is to decide that this may be the only report available for this attack and allow a NBC 2 NUC to be produced based on one NBC 1 NUC only. In such cases the subsequent procedures should be followed using the Flash-to-Bang Time.

0404. Distance from Observer to GZ or Flash-to-Bang Time and Angular Cloud Width

1. When distance from observer to GZ or flash-to-bang time and nuclear burst angular cloud width (measured at five minutes after burst) are known, enter the nomogram Figure A-I with a straight-edge or line at the measured data in the angular cloud width and flash-to-bang/distance to ground zero columns, and read the yield, where the straight-edge or line intersects the yield column.

Example:
Reported data:
Flash-to-bang time: 60 seconds
Angular cloud width: 275 mils

From Figure A-I determine yield as **50 KT.**

Note: The Flash-to-bang time should only be used when the distance to GZ is not known.

0405. Distance from Observer to GZ or Flash-to-Bang Time and Cloud Top and/or Cloud Bottom Angle

1. When distance from observer to GZ or flash-to-bang time and cloud top and/or cloud bottom angle (measured at ten minutes after burst) are known, use nomogram Figure A-II. Place a straight-edge or line at the measured data on the distance to ground zero/flash-to-bang and angle to top or bottom of cloud columns and read yield where the straight-edge or line intersects the yield cloud top or bottom columns as appropriate.

Example:
Reported data:

Distance from observer to GZ:	34,5 km.
Cloud top angle:	20 degrees

From nomogram Figure A-II determine yield as: **50 KT**

Note: The Flash-to-bang time should only be used when the distance to GZ is not known.

0406. Height of Stabilised Cloud Top and/or Cloud Bottom

1. When height of cloud top and/or cloud bottom (measured at ten minutes after burst) is known, the nomogram Figure A-III is used. Enter the nomogram with a straight-edge or line, used horizontally with the measured cloud parameter (cloud top or cloud bottom). Should both values be available and not give the same yield, select the larger value of the yield.

Example:
Reported data:

Cloud top height:	12 200 metres
Cloud bottom height:	8 300 metres

2. From the nomogram Figure A-III determine yield of **40 KT** for 12 200 metres (cloud top height) and **50 KT** for 8 300 metres (cloud bottom height), so the **50 KT** yield is selected. The graph Figure A-XI is also usable for this purpose.

0407. Yield Estimation in Ships

1. If stabilised cloud top height or cloud bottom height can be measured, the Figure A-XI may be used to estimate the yield. When cloud top or cloud bottom parameters are not available, ships will have to use the methods described in paragraphs 404 and 405.

CHAPTER 5

FALLOUT PREDICTION IN GENERAL

0501. Fallout Prediction Method

1. For the preparation of a fallout prediction, the following must be available:

   a. Meteorological data.

   b. Estimated yield.

2. The necessary meteorological data will be available in the format of a NBC Basic Wind Message (NBC BWM) or a NBC Effective Downwind Message (NBC EDM).

3. The method of fallout prediction consists of two procedures, the detailed procedure and the simplified procedure, both of which are used to determine the extent of the warning area. Normally the detailed procedure is used by agencies having a meteorological capability, and subordinate units use the simplified procedure. The decision as to which procedure is to be used is left to the commanders concerned. These two procedures are described in Chapter 6 and Chapter 7 respectively.

4. The prediction of the fallout hazard area using the detailed procedure is more accurate. Although neither procedure precisely defines the extent of the fallout, the predicted fallout area, calculated by either method, indicates the probable limits to which fallout of military significance will extend. When statistics of wind variability are available, the variable angle method provides the opportunity of basing the prediction on a probability calculation.

5. The boundaries of the predicted fallout area are not dose rate contour lines, nor do they imply that all points within the enclosed areas will sustain dangerous fallout.

0502. Definition of Fallout Area Zones

1. The predicted fallout area consists of Zone I and Zone II.

   a. Zone I is of Immediate Operational Concern. Within this Zone, there will be areas where exposed, unprotected personnel may receive doses of 150 cGy or greater in relatively short periods of time (less than 4 hours after actual arrival of fallout). Major disruptions to unit operations and casualties may occur in some parts of this zone. However, radiation risk category for emergency risk is changing from 150 cGy to 125 cGy.

   b. Zone II is a Secondary Hazard. Within this Zone, the total dose received by exposed, unprotected personnel is not expected to reach 150 cGy within a period of four hours after the actual arrival of fallout. Within this zone, personnel may receive a total dose of 50 cGy or greater within the first 24 hours after arrival of fallout. Personnel with no previous radiation exposure may be permitted to continue critical missions for as long as four hours after the actual arrival of fallout without incurring the 150 cGy emergency risk dose. However, radiation risk category for negligible risk is changing from 50 cGy to 75 cGy and the emergency risk category is changing from 150 cGy to 125 cGy.

c. Outside the two Zones. Outside the two predicted Zones, exposed, unprotected personnel may receive a total dose that does not reach 50 cGy in the first 24 hours after the actual arrival of fallout. However, radiation risk category for negligible risk is changing from 50 cGy to 75 cGy.
The total dose for an infinite stay time should not reach 150 cGy.

Note: Prediction of fallout is to be regarded as an estimate only. Necessary preparations should be made to avoid the hazard if tactically possible. Even within Zone I, units may not be affected by fallout at all. However, the decision to act is up to the local commander and national directives/SOPs.

0503. Significance of Fallout Ashore versus that at Sea

1. The detailed procedure and the simplified procedure for fallout prediction are intended for use by all services. They are based upon assumed land surface bursts. It is recognised that the fallout from a sea burst may be rather different, but very little direct information is available on fallout from bursts on the surface of deep ocean water.

2. It must be stressed that the sea acts like an absorbent of, and shield against, radioactive products, but they remain a hazard on land until they have decayed.

3. Another important difference is that recipients of warnings ashore do not have the mobility of ships at sea, and in most cases must deal with the danger "in situ". Therefore ships will be particularly interested in the determination of the approximate area in which deposition of fallout at the surface is taking place at a given time after burst.

4. Ships with a meteorological capability may be able to obtain the required meteorological data for computation of NBC EDM using standard pressure level winds. Basic wind data for this purpose are generally also available from meteorological sources (airbases, MET-ships or mobile weather stations). Ships, which do not have a meteorological capability, will normally predict fallout areas by using the simplified procedure.

5. The fallout warning system for merchant ships at sea is described in Chapter 11.

0504. Prediction of Fallout from Atomic Demolition Munitions (ADM)

1. Types of bursts normally applicable to Atomic Demolition Munitions (ADM) employment are surface bursts or subsurface bursts. The coverage of a residual radiation hazard area for a specific ADM detonation will depend largely on the depth of burial and selected yield.

2. The prediction procedure for ADM, slightly different from the normal detailed fallout prediction procedure, is not described in this ATP.

0505. Multiple Burst Fallout

1. No additional prediction procedure is available in the case of multiple burst fallout. The information obtained in areas where Zones overlap is to be interpreted as follows:

   a. The hazard classification of an area where fallout prediction patterns overlap should be that of the higher classification involved. That is an overlap area involving Zone I, should be designated Zone I, and an overlap area involving nothing more than Zone II should be designated Zone II.

   b. Examples:

      (1) Zone I overlapping Zone I - designated Zone I.

      (2) Zone I overlapping Zone II - designated Zone I.

      (3) Zone II overlapping Zone II - designated Zone II.

      (4) Zone II overlapping Zone I - designated Zone I.

CHAPTER 6

FALLOUT PREDICTION; DETAILED PROCEDURE

0601. The Detailed Procedure

1. This procedure requires nuclear burst or target analysis information and meteorological data. A fallout wind vector plot is prepared each time new meteorological data is received. Effective downwind speed, downwind direction, and width of predicted zone are determined from the wind vector plot. Effective downwind speed, effective downwind distance of Zone I, stabilised cloud radius, and the direction of left and right radial lines are transmitted (NBC 3 NUC) to subordinate units for immediate warning of predicted contamination resulting from a nuclear detonation.

0602. NBC Basic Wind Message/Forecast

1. The NBC Basic Wind Message (NBC BWM) and the NBC Basic Wind Forecast (NBC BWF) meteorological message contain information on the wind conditions, i.e. wind directions (from which the wind is blowing) and wind speeds in a number of layers from the surface of the earth to 30000 m altitude. Additionally, the zone of validity and time of measuring are stated.

2. The NBC BWM contains weather information for the following 6 hour period. The NBC BWF contains information for subsequent 6 hour periods.

3. Each layer has a thickness of 2000 m. The message begins with information on the wind conditions within the layer from the surface to 2000 m, then for the 2000 to 4000 m layer etc. A numerical identifier is used for each of the layers, beginning with 2 for the 0 m – 2000 m layer, 4 for the 2000 m – 4000 m layer etc.

4. The wind direction for each layer will be given with three digits (the direction from which the wind is blowing), and the wind speed with three digits. The unit of measurement will be indicated under set UNITM. Wind direction is normally given as Degrees/True North (DGT) and wind speed as Kilometres/Hour (KPH). (See Annex C).

5. The information may appear as either two blocks of three digits or one block of six digits:

<u>Examples</u>:

02 280030 or
02 280 030

6. All examples illustrating the detailed procedure for fallout prediction are related to the wind data given below.

0603. Example of a NBC Basic Wind Message

NBCEVENT/BWM//
UNITM/-/DGT/KPH/-//
ZULUM/140000ZSEP1999/140400ZSEP1999/141000ZSEP1999//
AREAM/NFEA1//
LAYERM/ 02/265/020/
04/290/030/
06/300/035/
08/310/035/
10/330/040/
12/345/040/
14/355/035/
16/005/030/
18/015/025/
20/020/015/
22/020/020/
24/025/020/
26/025/020/
28/030/020/
30/030/025//

Figure 6-I, Example NBC Basic Wind Message. See further details in Annex B.

1. The example above will be used for the purpose of constructing a wind vector plot and a fallout prediction following the detailed procedure in the paragraphs to follow.

0604. Wind Vector Plot

1. The information contained in the NBC BWM is used for the construction of a wind vector plot in the following way:

a. The wind directions given in the NBC BWM (para 603) are converted into downwind directions for each layer of height, by reversing the wind direction 180 degrees.

b. The wind speed of each layer as given in the NBC BWM is to be represented by a vector, the length of which is extracted from the appropriate table (Figure A-IV to A-IX in Annex A).

Example:
Prepare a wind vector plot to map scale 1:250000, using the meteorological information contained in the NBC BWM in para 603 (Figure 6-I).
The lengths of the wind vectors are extracted from the table related to map scale 1:250000 and wind speeds in the units of km/h (Figure A-VIII).

Layer	Downwind Direction (degrees)	Length of Vector (cm)
2	085	5.4
4	110	7.1
6	120	7.3
8	130	7.0
10	150	7.7
12	165	7.2
14	175	5.9
16	185	4.8
18	195	3.9
etc.		

c. Label Ground Zero (GZ), True North (TN), Grid North (GN), and from GZ draw a vector in the downwind direction of the layer 0 - 2000 m. The direction is 085 degrees respective to the TN direction. The length of the vector is 5.4 cm. Label the downwind end of the vector with the figure 2, and label the vector length alongside the vector.

2. This vector is now representing the downwind direction and the downwind speed within the height layer from the surface to 2000 m height. From the end of this vector, draw the next vector, the direction of which is 110 degrees and the length 7.1 cm. The downwind end of this vector is labelled 4, the vector thus representing downwind direction and downwind speed within the height layer 2000 m to 4000 m.

3. Proceed in the same manner, using all information given in the NBC BWM. The result will be a wind vector plot as shown in Figure 6-II.

0605. Fallout Calculation

1. Having drawn the wind vector plot, now determine the parameters for cloud top, cloud bottom and 2/3 stem height from the nomogram in Figure A-III. Enter the nomogram with a straight-edge or line used horizontally, connecting the estimated or reported yield on the left and right yield index scale. At the same time extract the parameters for cloud radius and time of fall from the cloud bottom.

Example:

Reported yield: **50 KT**

From Figure A-III determine the parameters for 50 KT:

Cloud top height	**12 700 metres**
Cloud bottom height	**8 300 metres**
2/3 stem height	**5 500 metres**

Cloud radius **5 kilometres**
Time of fall **2.35 hours**

Proceed as follows, using the wind vector plot on Figure 6-II:

a. Radial Lines. Label the points representing the cloud top height, cloud bottom height and 2/3 stem height on the fallout wind vector plot (see Figure 6-III).
Draw radial lines from GZ through these points.
Disregard all wind vectors at altitudes below the 2/3 stem height and above the cloud top height point for the prediction being prepared. If wind vectors between these points fall outside the radial lines drawn from GZ to these points, expand the angle formed by the radial lines, to include these outside vectors.

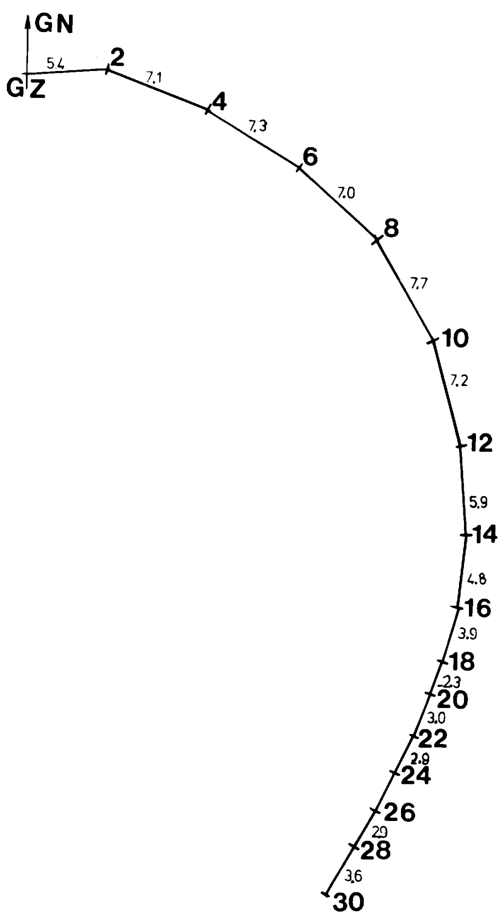


Figure 6-II, Wind Vector Plot.

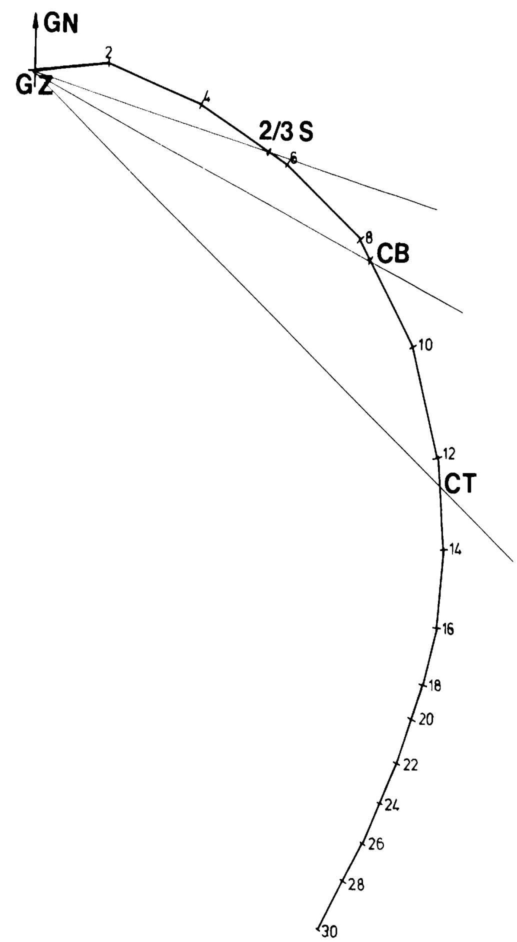


Figure 6-III, Wind Vector Plot with Cloud and Stem Radial Lines (50 KT).

b. Determine the effective Downwind Direction: Bisect the angle formed by the radial lines GZ to cloud top height and GZ to 2/3 stem height. (See figure 6-IV).
The orientation of the bisector defines the effective downwind direction. In the case where the angle of the radial lines has been expanded, the bisector will be drawn using the expanded angle.

c. Determine the Sector Angle by using one of the following Methods:

(1) Fixed Angle. If the angle formed by the radial lines (GZ to cloud top height and GZ to 2/3 stem height) is 40 degrees or greater, proceed to para 605.d. If less than 40 degrees, bisect the angle and expand the angle formed by the two radial lines to 40 degrees, 20 degrees left and 20 degrees right of the bisector (Figure 6-IV). In cases where the angle has been expanded (para 605.a.), the expanded angle will be used.

NOT TO SCALE

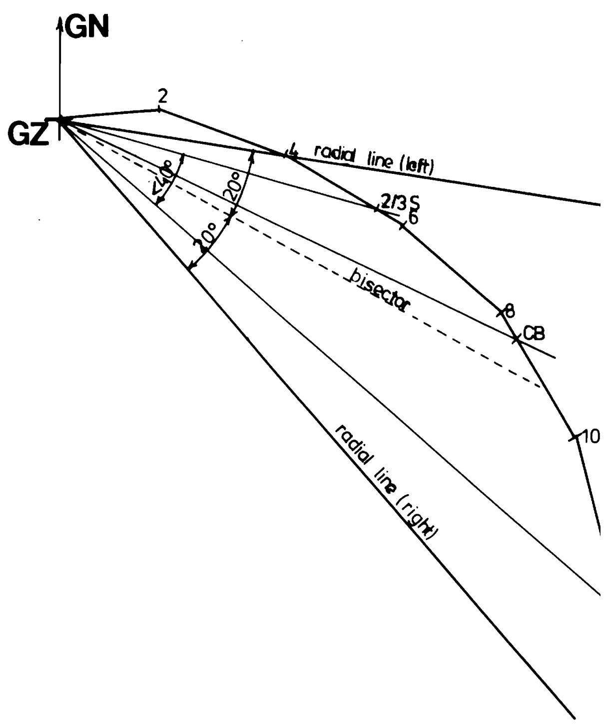


Figure 6-IV, Wind Vector Plot with expanded Radial Lines.

(2) Variable Angle. This optional method is based upon a probability calculation. The user will decide the angular displacement. A table giving an example of angular variation as a function of effective wind speed and yield, using 80% probability, is given in Figure 6-V.

Note: NBC centres will determine which of the two procedures is to be used within their subordinate areas of command.

Effective Wind Speed (km/h)	Half Sector Angle (degrees)
8	48
10	43
12	38
14	35
16	32
18	30
20	28
22	26
24	25
26	23
28	22
30	20
35	18
40	17
45	16
50	15
55	14
60	13
70	12
80	11
90	10
100	09

Figure 6-V, Angular Variation as a Function of Effective Wind Speed and Yield for the Northwest European Area.

Notes:

1. For optional use with locally measured Wind Data only.

2. The probability level of 80% applies for 5 KT to 300 KT yields for the period November to March. For yields outside this range and for the period April to October, the probability will be higher than 80%.

d. Determine the Effective Downwind (EDW) Speed:
Measure the length of the radial line from GZ to the point for cloud bottom height, and convert the measured length to distance (km), using the map scale in which the wind vector plot is drawn. Read the time of fall from Figure A-III corresponding to the cloud bottom and compute as follows:

$$\text{EDW speed} = \frac{\textbf{distance GZ to cloud bottom}}{\textbf{Time of fall}}$$

Example:
The distance measured from GZ to the point for cloud bottom is 26.8 cm, equal to 67 km when using map scale 1:250000. (1 km = 4 mm).

The time of fall from cloud bottom for 50 KT is 2.35 hours (Figure A-III), and the effective downwind speed is calculated as follows:

$$\textbf{EDW speed} = \frac{\textbf{67 km}}{\textbf{2.35 hours}} = \textbf{28.5 km/h}$$

e. Determine the Downwind Distances of Zone I and Zone II:
On the nomogram Figure A-X align a straight edge or line from the yield on the right hand scale to the wind speed scale. At the intersection of the straight-edge with the centre scale, read the value of the downwind distance of Zone I for a burst producing fallout. Multiply the Zone I distance by 2, to obtain the downwind distance of Zone II (distance from GZ to outer limit of Zone II).

Example:

Using the effective downwind speed (EDW speed) of 28.5 km/h and 50 KT yield, enter the nomogram Figure A-X, and determine the downwind distance of Zone I to be 40 km.
The downwind distance of Zone II is 40 km, multiplied by 2, equal to 80 km.
On the plot, using GZ as centre, draw two arcs with radii equal to the downwind distances of Zone I (40 km) and Zone II (80 km) respectively, between the two radial lines (see Figure 6-VI).

f. Determine the Cloud Radius:
Obtain the cloud radius (km) from the nomogram in Figure A-III, and draw a circle around GZ, using this radius.

Example:
Continuing the example used in para 605, the cloud radius for a 50 KT weapon is 5 km (from Figure A-III). On the plot, draw a circle using GZ as centre and 5 km (20 mm) as radius (Figure 6-VII).

g. Determination of Zone I and Zone II boundaries:
Draw two lines tangent to the cloud radius circle, and intersecting the points on the radial lines where the Zone I downwind distance arc intersects these lines. (Figure 6-VII).
The Zone I downwind distance arc, the two tangent lines and the upwind cloud radius semi-circle form the boundaries of Zone I. The Zone II distance arc, the Zone I distance arc and the two radial lines form the boundaries of Zone II.

NOT TO SCALE

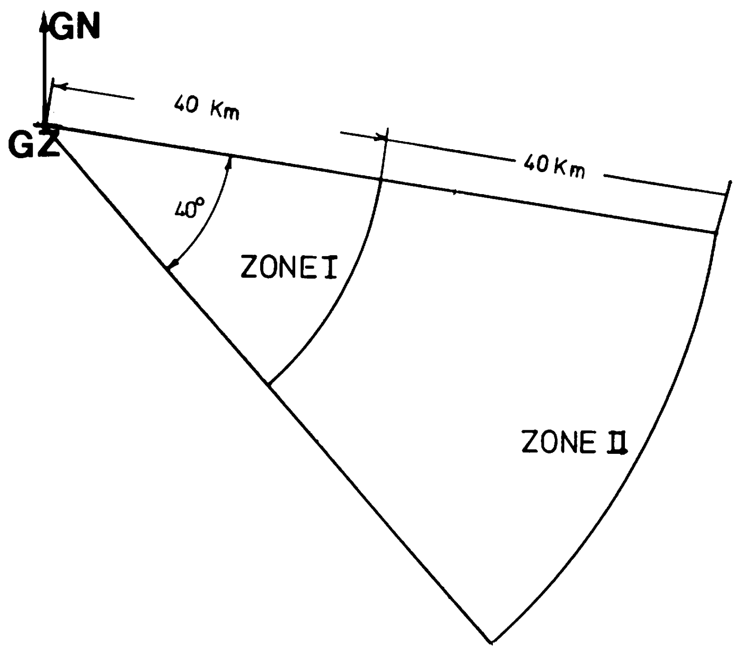


Figure 6-VI, Radial Lines, Zone I and Zone II Arcs.

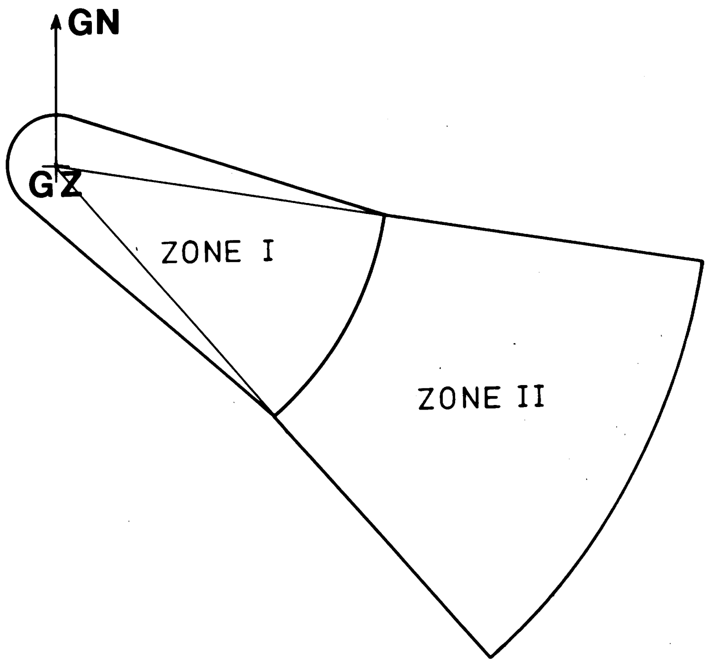
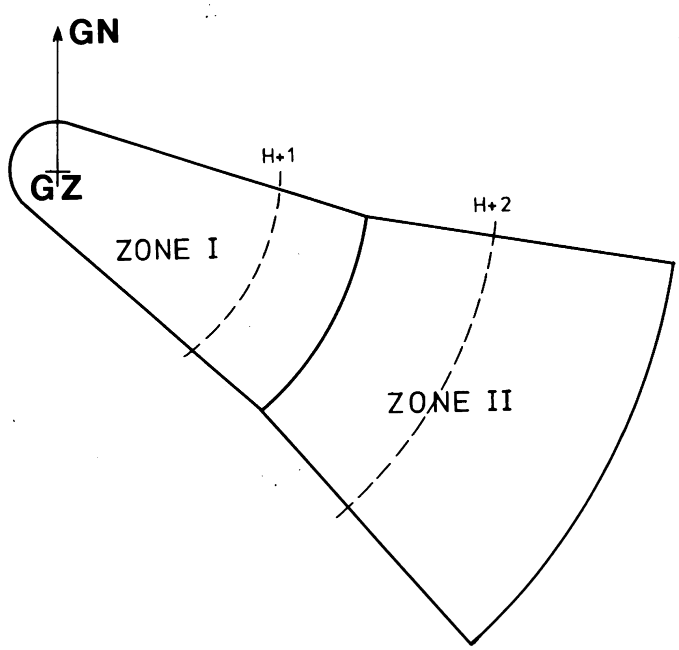


Figure 6-VII, Cloud Radius Circle and Tangent Lines.

Weapon Yield	50 KT
Basic Wind Message	140400Z
Date-time of Attack	140608Z
Location of Attack (GZ)	NB157486 ACTUAL
Effective Downwind Speed	28.5 km/h
Map scale	(as appropriate)



NBC 3 NUC (ADP version).
Common MSG heading followed by:
NBCEVENT/NUC//
ALFA/UK/310/UK1-03004/N//
DELTA/140608ZMAR1999//
FOXTROT/32UNB157486/AA//
NOVEMBER/50//
PAPAB/029KPH/040KM/05KM/100DGG/140DGG//

Figure 6-VIII, Completed Detailed Fallout Prediction Plot and NBC 3 NUC

h. Time of Fallout Arrival:
Using GZ as centre, indicate the estimated time of arrival of fallout by drawing dotted arcs downwind of GZ, at distances equal to the product of the effective downwind speed and each hour (or fractions of hour) of interest.

Example:
Effective downwind speed is 28.5 km/h, therefore it is estimated that fallout will arrive 28.5 km downwind from GZ at one hour after the burst (H+1) and 2 x 28.5 = 57 km downwind from GZ at two hours after the burst (H+2). Draw the two dotted arcs, using GZ as centre and 28.5 and 57 km as radii, and label the arcs "H+1" and "H+2" respectively. (See Figure 6-VIII).

i. Complete the Fallout Plot:
Label the plot to indicate the map scale used, the yield (estimated or actual), date-time of attack, location of attack and NBC BWM used for preparation of the wind vector plot (see Figure 6-VIII).

0606. Special Case

1. When the effective downwind speed is less than 8 km/h, the predicted fallout area will be circular, the radii of two concentric circles around GZ being equal to the Zone I downwind distance and the Zone II downwind distance respectively.

2. The downwind distance of Zone I can be determined using the nomogram Figure A-X. Enter the nomogram with the yield and an effective downwind speed of 8 km/h.

2. Read the value of the Zone I downwind distance and multiply the distance by 2 to obtain the downwind distance of Zone II.

CHAPTER 7

FALLOUT PREDICTION; SIMPLIFIED PROCEDURE

0701. The Simplified Procedure

1. The simplified fallout prediction method requires nuclear burst information, a current NBC Effective Downwind Message (NBC EDM), and a simple template (radiological fallout predictor).

2. This procedure affords the subordinate commands direct and immediately usable means to estimate the fallout hazard with the least possible delay. Effective downwind speed and downwind direction for each of seven selected weapon yields are transmitted periodically to subordinate units by higher headquarters, in the form of the NBC EDM, to enable subordinate commanders to use the simplified procedure.

3. A NBC EDM can be produced at NBC Centres and meteorological centres from the NBC BWM (see Chapter 6) or by use of standard pressure level winds (see Chapter 10).

4. The format of a computer originated NBC EDM is shown in Annex B.

5. A NBC Effective Downwind Forecast (NBC EDF) is produced at designated meteorological centres from computer originated forecast winds. The NBC EDF is designed for planning purposes at NATO commands and higher national commands. It may be used at lower levels (NBC Collection or NBC Sub Collection Centres) only if actual wind data or NBC EDM are not available.

6. A simple template and estimated yield of a particular burst are all that is needed in addition to the NBC EDM/NBC EDF.

7. The format of the NBC EDF is the same as the format of the computer originated NBC EDM as shown in Annex B.

0702. The NBC EDM

1. Since effective downwind speed and effective downwind direction vary with the yield, seven downwind speeds and downwind directions are transmitted, corresponding to seven preselected yield groups, ALFA through GOLF as follows:

ALFA	**is**	**≤**	**2 KT**		
BRAVO	**is**	**>**	**2 KT**	**≤**	**5 KT**
CHARLIE	**is**	**>**	**5 KT**	**≤**	**30 KT**
DELTA	**is**	**>**	**30 KT**	**≤**	**100 KT**
ECHO	**is**	**>**	**100 KT**	**≤**	**300 KT**
FOXTROT	**is**	**>**	**300 KT**	**≤**	**1000 KT (1 MT)**
GOLF	**is**	**>**	**1000 KT**	**≤**	**3000 KT (3 MT)**

2. To calculate the data, use the procedure in Chapter 6 with 2 KT for ALFA, 5 KT for BRAVO, and 30 KT for CHARLIE and so on.

3. This data will be transmitted in the following basic format:

NBC EDM

Common message heading followed by:
NBCEVENT/EDM//
AREAM/RRRRR//
ZULUM/ddttttZMMMYYYY/ddttttZMMMYYYY/ddttttZMMMYYYY//
UNITM/LL/DDD/SSS/-//
ALFAM/-/ddd/sss/-//
BRAVOM/-/ddd/sss/-//
CHARLIEM/-/ddd/sss/-//
DELTAM/-/ddd/sss/-//
ECHOM/-/ddd/sss/-//
FOXTROTM/-/ddd/sss/-//
GOLFM/-/ddd/sss/-//

4. In the NBC EDM basic format, ZULUM ddttttZMMMYYYY is the date and time at which the real winds are measured (e.g. 250600Z is the 25th day of the month at 0600Z). LL/DDD/SSS/ are the units of measurement being used e.g. LL = km (KM), DDD = degrees true north (DGT) and SSS = knots (KTS). ddd is effective downwind direction in degrees, and sss effective downwind speed in knots (e.g. ALFA 080025 is a downwind direction of 080 degrees and 025 an effective downwind speed of 025 knots, valid for yields of 2 KT or less.

5. The format transmits data determined at the Collection Centre or lower level where the detailed fallout prediction procedure is used.

6. The computer originated NBC EDM - while following the basic format - has a different layout together with a period of validity. The format is covered in detail in Annex B.

7. These data are transmitted to subordinate levels to permit use of the simplified procedure.

0703. Use of NBC EDM and Template

1. From the NBC EDM determine the downwind direction for the specific yield group. Draw a line from the centre of the circles (GZ) on the template through the downwind direction in degrees on the template compass rose. Mark this line GN.

2. Use the nomogram on Figure A-X to determine the downwind distance of Zone I. The downwind distance of Zone II is the double of the Zone I downwind distance.

3. Draw arcs between the two radial lines, using GZ as centre and the Zone I and Zone II downwind distances as radii and draw the tangents from the specific yield group semi circle to the intersection points of the Zone I arc with the radial lines.

4. Using the effective downwind speed for the specific yield group, draw and label dotted lines within the warning area to indicate the estimated times of arrival of fallout.

5. Place the GZ of the template over the GZ on the map, and align the template GN with the map GN. The arcs, the radial lines and the yield group semi circle determine the extent of the warning area.

6. Some of the above listed details may be omitted from the template if such details are already available on the situation map.

Example:

A nuclear detonation has occurred, and based upon the observations taken, the yield has been estimated to be 35 KT and type of burst is surface burst.

The following NBC EDM is available:

NBC EDM

Common message heading followed by:
NBCEVENT/EDM//
AREAM/NFEA//
ZULUM/271100ZMAY1999/271200ZMAY1999/271800ZMAY1999//
UNITM/KM/DGT/KPH/-//
ALFAM/-/095/020//
BRAVOM/-/102/024//
CHARLIEM/-/115/028//
DELTAM/-/122/029//
ECHOM/-/126/029//
FOXTROTM/-/132/029//
GOLFM/-/140/035//

7. Based upon the information above, a fallout prediction, by use of the simplified procedure, can be prepared as follows:

a. Yield Group Determination: As 35 KT is between 30 KT and 100 KT, select yield group DELTAM from the NBC EDM.

b. The Grid North Line: As the downwind direction for yield group DELTAM of the NBC EDM is 122 degrees, draw the GN line from the centre of the yield semi circles through 122 degrees on the inverted compass rose (Figure 7-III).

c. Zone I Downwind Distance Determination: Using the effective downwind speed of 29 KPH and the 35 KT yield, determine the downwind distance of Zone I from the nomogram Figure A-X to be 33 km. Therefore the Zone II downwind distance is 66 km. Draw the contour extension around GZ from DELTAM semi circle (using the 100 KT cloud radius) to the intersection of the Zone I arc with the radial lines. (See Figure 7-III).

d. Estimated Times of Arrival of Fallout: Using the effective downwind speed of 29 KPH, indicate the times of arrival of fallout by dotted arcs at 29 km and 58 km downwind; label these lines H+1 and H+2 respectively. (See Figure 7-III).

e. Complete the template: Label the template to indicate the scale, the estimated yield in KT, the date and time of attack, the location of the attack and the NBC EDM used for the prediction.

f. Use of the Template: Place GZ of the template over the GZ on the map, and align GN of the template with the map GN.

0704. Special Cases

1. Effective Downwind Speed less than 8 KPH (or 4.32 KTS): When the effective downwind speed is less than 8 KPH for a given yield group, the applicable line of the NBC EDM will contain only three digits, giving the downwind distance of Zone I. An effective downwind direction is not transmitted in the NBC EDM, since in this case the downwind distance of Zone I describes the Zone I as a circle around GZ. Zone II will then be within another circle around GZ, the radius of which is double the radius of the Zone I circle. In the NBC EDM in Figure 7-I, the yield groups ALFAM and BRAVOM reflect only the downwind distance of Zone I in km. The downwind distance becomes the radius of a circle around GZ, describing Zone I. A second circle of twice the radius of Zone I will define Zone II.

NBC EDM
Common message heading followed by:
NBCEVENT/EDM//
AREAM/NFEA//
ZULUM/271100ZMAY1999/271200ZMAY1999/271800ZMAY1999//
UNITM/KM/DGT/KPH/-//
ALFAM/004//
BRAVOM/007//
CHARLIEM/-/210/014//
DELTAM/-/220/016//
ECHOM/-/225/020//
FOXTROTM/-/230/030//
GOLFM/-/240/035//

Figure 7-I, Example NBC EDM Containing Special Cases on Wind Speed less than 8 KPH for sets ALFAM and BRAVOM.

2. Angle Expansion: The simplified procedure does not normally provide for a warning angle greater than 40 degrees. In the instances where the detailed procedure

demands an angle greater than 40 degrees, this warning area angle is to be given in the NBC EDM to subordinate units to expand their original warning area.

3. In computer originated NBC EDM, the angle expansion will be shown in field 4 of each of the yield groups, as shown in the example below (Figure 7-II). This means, that for yield groups FOXTROTM and GOLFM, the 40 degrees standard angle between the two radial lines must be expanded to 60 degrees, i.e. 30 degrees on each side of the reference line.

4. If the angle is greater than 120 degrees, the detailed procedure must be used to determine the exact angle.

NBC EDM
Common message heading followed by:
NBCEVENT/EDM//
AREAM/NFEA//
ZULUM/271100ZMAY1999/271200ZMAY1999/271800ZMAY1999//
UNITM/KM/DGT/KPH/-//
ALFAM/004//
BRAVOM/007//
CHARLIEM/-/210/014/4//
DELTAM/-/220/016/4//
ECHOM/-/225/020/4//
FOXTROTM/-/230/030/6//
GOLFM/-/240/035/6//

Figure 7-II, Example NBC EDM Indicating Special Cases.

Explanation of the 7th digit:

4	**=**	**40 degree angle**
5	**=**	**50 degree angle**
6	**=**	**60 degree angle**
7	**=**	**70 degree angle**
8	**=**	**80 degree angle**
9	**=**	**90 degree angle**
0	**=**	**100 degree angle**
1	**=**	**110 degree angle**
2	**=**	**120 degree angle**
3	**=**	**more than 120 degree angle.**

(The detailed procedure must be used to determine the exact angle).

Scale:	1: 250 000
Estimated Yield:	35 KT
Date-time of Attack:	271220ZMAY1999
Location of Attack:	31UUB208196
NBC EDM:	271200Z

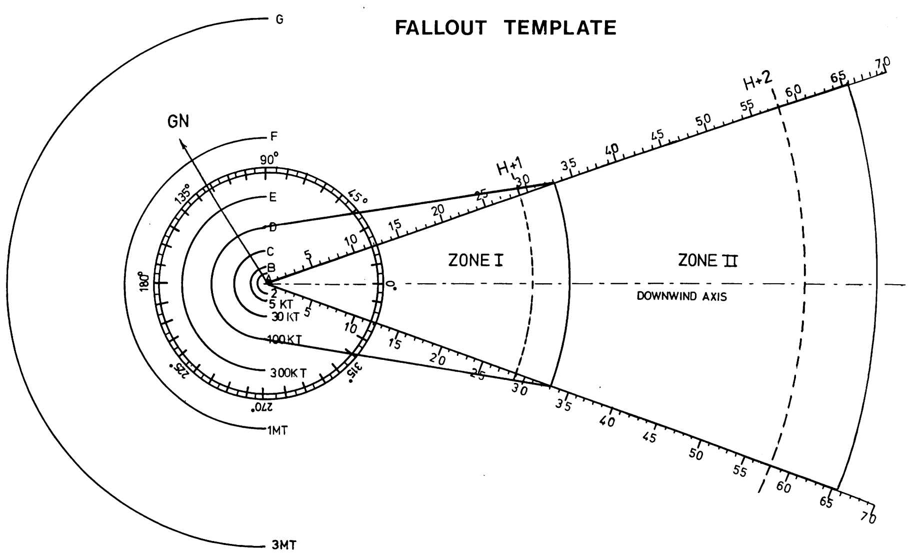


Figure 7-III, Fallout Template with Fallout Prediction Plot.

CHAPTER 8

RECORDING AND CALCULATION OF RADIOLOGICAL CONTAMINATION

0801. Locating and Reporting Radiological Contamination

1. Fallout predictions provide a means of locating probable radiation hazards (see chapter 4 - 7). Military significant fallout is expected to occur only within the predicted area. However, the prediction does not indicate exactly where the fallout will occur or what the dose rate will be at a specific location. Rainout or washout can also increase radiological contamination on the ground creating local hot spots. Areas of neutron induced radiation also can be caused by low air bursts.

2. Before planning operations in a nuclear environment, commanders must be aware of these residual contamination hazards. The information required for such planning is derived from the equations and nomograms given in the following sections and in AEP-45. The basic information needed is contained in NBC 4 NUC reports. They provide information on actual measured contamination in the form of dose rates.

0802. Airborne Radioactivity

1. Most contaminated particles in a radioactive cloud rise to considerable heights. Thus, fallout may occur over a large area. It may also last for an extended period of time. A survey conducted before fallout is complete would be inaccurate, because contaminants would still be suspended in the air. For this reason, as well as the hazard to surveying personnel, radiological surveys are not conducted before completion of fallout.

2. An estimate of the time of completion (T_{comp}) of fallout for a particular location may be determined using a mathematical equation. The time in hours after burst when fallout will be completed at any specific point is approximately 1.25 times the time of arrival of fallout (in hours after burst). Add the time in hours required for the nuclear cloud to pass over.

3. This is expressed by using the formula:

$$T_{comp} = 1.25 \times T_{arrival} + \frac{2 \times \text{Cloud radius}}{\text{Effective wind speed}}$$

Example.

For a given location, the following data has been determined:
- Time of detonation = H
- Time of arrival = H+2 hours
  (Time of arrival is determined by dividing the distance from GZ to the given point by the effective wind speed)

- Cloud diameter = 4 km (equals 2 x cloud radius)
  (Cloud diameter/radius is determined either from Figure A-III of Annex A or the appropriate equation from AEP-45, Annex D or from set PAPAB of the NBC 3 NUC report)
- Effective wind speed = 20 KPH
  (Effective wind speed is determined from set YANKEE of the NBC 3 NUC report)

$$T_{comp} = 1.25 \times 2h + \frac{4\,km}{20\,KPH} = 2.5h + 0.2h = 2.7h$$

4. Thus, fallout for the given location is expected to be complete by H + 2.7 hours.

5. Actual completion of fallout can be determined if a peak NBC 4 NUC report is received from the area of interest.

0803. Measuring Radiological Data

1. Measurements of radiological data must be taken in accordance with the unit's SOPs. Measurements can be taken directly from an unshielded position if dose rates are low enough, or from a shielded position such as a shelter or vehicle.

2. When the indirect technique is used, most of the readings are taken inside the vehicle or shelter. However, at least one outside reading is necessary to determine the transmission factor, which relates the readings inside to the unshielded values outside. The latter are to be reported since they are necessary for further calculations pertaining to troops in the open, or other vehicles, or shelters.
To determine the transmission factor both the inside and outside readings must be taken after fallout is complete. Calculate the transmission factor using the following formula:

$$Transmission\ Factor\ (TF) = \frac{Inside\ dose\ rate}{Outside\ dose\ rate}$$

NOTE: TF is always less than 1.
It can be determined from the measurement of the dose as well.

3. The readings taken inside the vehicle or shelter represent inside shielded dose rates (ID). These readings must be converted to outside, unshielded dose rates (OD) before reporting. Readings are converted using the following formula:

$$OD = ID / TF$$

4. A precalculated list of TF is contained in national manuals, an example of which is shown in Figure A-XVI of Annex A. This information is <u>not</u> used by the unit NBC defence personnel when calculating or reporting outside dose rates. Its principal use is

to establish the relative shielding ability of one shelter, structure, or vehicle as compared to another. It is also used for instructional and practice purposes.

5. These factors are for the most exposed occupied location. They are not based on dose rates from fallout; they are based on gamma radiation from cobalt-60. Since cobalt-60 radiation is almost twice as strong as the radiation from fallout, actual TF should be much lower (more protection).

6. In some cases the term protection factor (PF) (or correlation factor (CF)) is used. It is always the reciprocal of the transmission factor.

$$PF\ (or\ CF) = \frac{1}{TF} = \frac{OD}{ID}$$

0804. Surveys

1. Air-Ground Correlation Factors (AGCF). AGCF is required for calculation of surface dose rates from aerial dose rates taken in an aircraft during a survey. The air ground correlation factor relates a ground dose rate reading to a reading taken at approximately the same time in an aircraft at survey height over the same point on the surface.

2. The AGCF is calculated as shown below:

AGCF	**=**	**Ground dose rate / Aerial dose rate**
Example:		
Surface dose rate	**=**	**20 cGy/h**
Aerial dose rate (200 feet survey height)	**=**	**5 cGy/h**
AGCF	**=**	**20 cGy/h / 5 cGy/h**
AGCF	**=**	**4**

3. By multiplying the readings taken in the aircraft at a survey height by the AGCF, the surface level reading can be approximated. These values are to be reported in the NBC 4 NUC.

Ground dose rate	**=**	**Air dose rate x AGCF**

0805. Reporting Instructions

1. Monitoring data to be sent to other units/HQ's is transmitted in the NBC 4 NUC report format (Chapter 2, para 206).

a. Automatic Reports.
In accordance with SOPs units in the contaminated area submit certain monitoring reports automatically. These provide the minimum essential information for warning, hazard evaluation, and survey planning. Reports are sent through specified channels to reach the NBC cell.
The automatic reports are the initial, peak, and special reports specified by the NBC centre or required by commanders for operational purposes.

b. Initial Report.
After noting a dose rate of 1 or more cGy/h outside, defensive measures in accordance with SOPs are implemented, and the unit formats a NBC 4 NUC report containing the code "INIT" for initial in set ROMEO.
The first report is used at the NBC centre to confirm the fallout prediction.
The dose rate cannot be converted to H+1 at this time.

c. Peak Report.
After the initial contamination is detected the unit monitor continuously records dose rates according to the time intervals specified in unit SOPs.
The dose rate rises until it reaches a peak, and then it decreases.
In some cases, the dose rate may fluctuate for a short time before beginning a constant decrease.
When the measurement continues to decrease, the monitor takes an inside reading and then an outside reading for the TF calculation. First, the inside reading is recorded. Within three minutes, the monitor goes to the outside location.
After all information is recorded, the NBC defence team calculates the TF and applies it to the highest dose rate. It then formats the NBC 4 NUC report. The word "PEAK" is used in set ROMEO.

d. Special Reports.
Other standing instructions may establish the requirement for special NBC 4 NUC reports. The NBC centre evaluates these special reports. They invite command attention to areas or conditions of serious concern. The operational situation, unit radiation status, and similar considerations determine the criteria for these special reports, which cannot be specified here. Generally, this report may be required when the surface dose rate goes above a specified value. When the dose rate increases after showing continuous decrease, a special report must be sent. Special reports may be required after a specified period of time if the unit remains in the area.

e. Directed Reports.
Selected units in the contaminated area will be directed to submit additional NBC 4 NUC reports. The NBC centre uses these reports to

evaluate a radiological contamination hazard - the decay rate of fallout and how long this decay rate (and the contamination overlay) will remain valid. They are used to determine the H-hour (if unknown) and the soil type in neutron induced areas.
Reliable calculations are directly related to the precision of the dose rate measurement. Tactical decisions and personnel safety depend on the accuracy of these measurements. The assessment of further development of the contamination situation depends upon this data. An error in dose rate measurements means a similar error in all following calculations.

f. Series Reports.
A series report consists of a series of dose rate readings taken at the same location at time intervals specified in unit SOPs after the peak dose rate has been recorded. The location must remain constant. The report contains each reading and the time it was taken. The report contains the word SERIES in set GENTEXT.

g. Summary Reports.
The summary report shows the radiation distribution throughout units area of responsibility. The locations for the readings are selected by the unit according to the distribution of its elements and the extent or variety of the area’s terrain. The time each reading was taken is reported. The word SUMMARY is given in set GENTEXT.

h. Verification.
The verification report is a unit's response to a direct request. If data are lacking from a specific location near or in the unit's area the NBC centre may request a verification report. It may also be requested to confirm abnormal readings reported earlier. A verification report is not a retransmission of the earlier report, but a check of the actual conditions of the area. The unit tasked with the submission of a verification report receives specific instructions as to the location from which a reading is desired. The word VERIFY is used in set GENTEXT to indicate a verification report.

0806. Report Formatting Instructions at the NBC Centre

1. For the format used to pass monitoring and survey results see the NBC 4 NUC report as described in Chapter 2, para 206.

2. The format is as follows:

NBC 4 NUC

Set	Meaning
QUEBEC	**Location and type of reading/sample/detection.**
ROMEO	**Contamination level, dose rate trend, decay rate.**
SIERRA	**Date and time of reading or initial detection of contamination.**

3. The location is sent as UTM grid co-ordinates; the level of contamination reading is expressed in cGy/h.

4. Sets QUEBEC, ROMEO, and SIERRA may be repeated as many times as necessary to give a specific picture of the contamination throughout an area. A "zero" dose rate may also be reported on set ROMEO, and is an extremely valuable piece of information in determining the extent and duration of contamination.

5. Only outside dose rates are reported by the unit, and the date time group is reported in ZULU time. Certain abbreviations are associated with the dose rate to describe the circumstances surrounding the contamination. Note that the definition of set ROMEO includes information on the dose rate trend and the relative or actual radiation decay rate. The dose rate must be reported while the latter two items are optional. They require evaluation, which may be done above unit level. A monitor cannot provide this information.

Dose rate trends are:

INIT	**-**	**initial reading**
PEAK	**-**	**peak reading**
DECR	**-**	**decreasing since last reading**
INCR	**-**	**increasing since last reading**
SAME	**-**	**same**

Legal entries for the relative decay rate are: (see para 807 and 808)

DN	**-**	**decay normal**
DF	**-**	**decay faster than normal**
DS	**-**	**decay slower than normal**

Figure 8-I shows examples of NBC 4 NUC reports.

NBC 4 NUC
QUEBEC/32UNB156470/GAMMA//
ROMEO/1CGH/INIT//
SIERRA/021200ZAUG1999//

NBC 4 NUC
QUEBEC/32UNB156470/GAMMA//
ROMEO/20CGH/INCR//
SIERRA/021245ZAUG1999//

NBC 4 NUC
QUEBEC/32UNB156470/GAMMA//
ROMEO/40CGH/PEAK//
SIERRA/021330ZAUG1999//

NBC 4 NUC
QUEBEC/32UNB156470/GAMMA//
ROMEO/35CGH/DECR//
SIERRA/021400ZAUG1999//

NBC 4 NUC
QUEBEC/32UNB156470/GAMMA//
ROMEO/30CGH/DECR//
SIERRA/021430ZAUG1999//

NBC 4 NUC
QUEBEC/32UNB156470/GAMMA//
ROMEO/27CGH/DECR/DN//
SIERRA/021500ZAUG1999//

NBC 4 NUC
QUEBEC/32UNB156470/GAMMA//
ROMEO/25CGH/DECR//
SIERRA/021530ZAUG1999//

NBC 4 NUC
QUEBEC/32UNB156470/GAMMA//
ROMEO/23CGH/DECR//
SIERRA/021600ZAUG1999//

NBC 4 NUC
QUEBEC/32UNB156470/GAMMA//
ROMEO/21CGH/DECR//
SIERRA/021630ZAUG1999//

Figure 8-I, Examples of NBC 4 NUC Reports

0807. Evaluation of Radiological Information

1. After NBC 4 NUC reports are available they must be evaluated with regard to the actual hazard encountered by troops in the contaminated area with the aim to predict expected dose rates and accumulated dosages for possible missions within the contaminated area. Theoretically, once a radiological hazard has been identified, the contamination existing at any future time can be calculated using simple decay relationships.

2. The dose rate at any location in a fallout area does not remain constant. It decreases with time according to the Kaufmann equation:

$$\boldsymbol{R_1 \times t_1^{\,n} = R_2 \times t_2^{\,n}}$$

Which describes the decay of fallout after it has completely settled on the ground.

In this equation:

R **is the dose rate at the location.**
t **is the time in hours after H-hour.**
n **is the decay rate.**

3. The subscripts ‘1‘ and ‘2‘ denote two separate dose rate measurements taken at the same location at different times.

4. Dose rate and total dose calculations cannot be performed until the decay rate is known. The true decay rate will not be known immediately. Accurate determination must wait until several sets of NBC 4 NUC reports are available.

5. The decay rate of fallout depends on many factors. Some of these factors are:

a. Height and type of burst.

b. Type of weapon (fission, fission-fusion, fission-fusion-fission).

c. Type of active materials, as well as construction and structural materials within the weapon.

d. Type and quantity of materials vaporised or sucked up into the fireball.

e. "Salting" the weapon to produce a slow decay.

f. When fallout overlaps fallout.

g. Soil Type.

6. The decay rate varies with time. Generally, the decay rate becomes slower as time passes.

7. The same decay rate may not be present across the entire fallout area. The pattern as a whole will have an average value, which may vary from position to position. The amount of variation in the decay rate for fallout is expected to range from 0.2 to 2.0. The lower values are assumed for "salted" weapons.

8. Decay calculations are valid only if the dose rate readings are made after completion of fallout. While fallout is still arriving, the Kaufmann equation is not valid.

9. Because of the delay in determining the actual decay rate, an assumed decay rate of **n** = 1.2, referred to as standard decay, is used by all units until informed otherwise by the NBC centre. When the actual decay rate has been established by the NBC centre, it will be sent as set ROMEO on the NBC 4 or NBC 5 NUC report. The assumed normal decay rate of **n** = 1.2 is used in many simplified radiological calculation procedures. Optimum time of exit calculations are also based upon **n** = 1.2.

> **Note**: In the equations of the following sections all times are given in hours after the burst. The information given in corresponding sets of the NBC messages (e.g. SIERRA) must be converted appropriately when moving from calculation to reporting or vice versa.

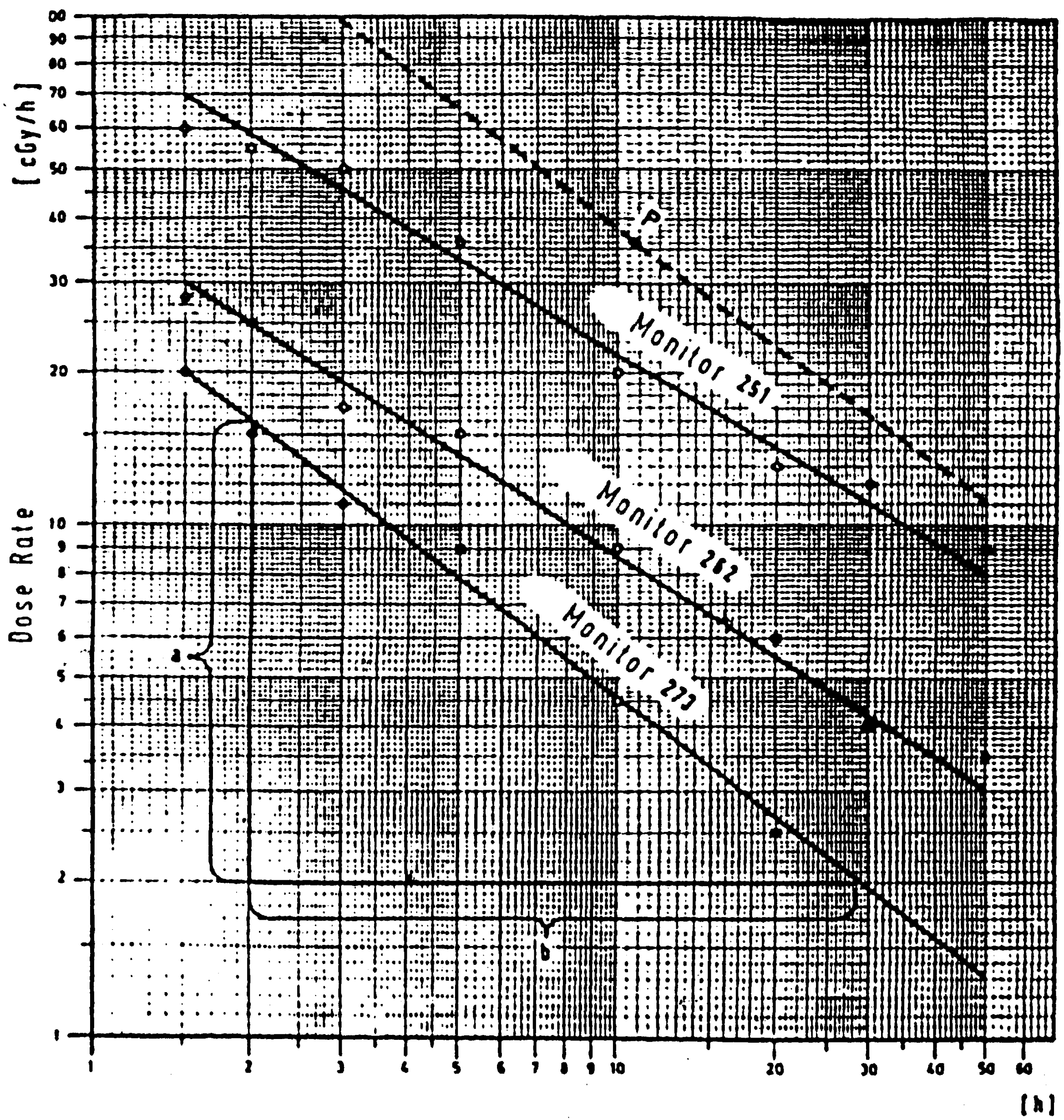
0808. Determination of Decay Rate

1. Mathematical Method (AEP-45, Annex D, Appendix D-19).

2. Graphical Method.

   a. When a sequence of dose rates (NBC 4 NUC reports) from one location is plotted on log-log graph paper, the decay rate of the contamination will cause the line plotted to be a straight line, inclined at a slope (**n**) to the axes of the graph.

   b. Figure 8-II shows data plotted on log-log graph paper for 3 locations. The time is used as the number of hours past H-hour. A set of three lines is drawn through the points. The slope of the line is **n** = **a/b**, the decay exponent for each location. The best straight line is fitted to the points. The value of n may then be determined for each location and an average n determined for the area. If the slopes of the lines differ by more than 30% from one location to the next, a mean value cannot be defined, and the decay rate determined for a given location can only be applied in the immediate vicinity of that location.



TIME (H-hour + NUMBER OF HOURS)

Figure 8-II, Decay Rate Determination
(Measurement of Slope).

3. To predict the development of the decay at any other point **P** in the area, plot a reading from point **P** on the graph and draw a line with the slope of n through this point as shown at the top of the figure. In this way the dose rate at this point can be estimated for any time **H + t**.

4. Different graphical aids may be designed by nations or units to assist in determining the decay rate. An example for an overlay is given in Figure A-XVII of Annex A. To use it proceed as follows:

Plot the dose rate readings versus time as in Fig 8-II.

5. Place the overlay on the figure and move it up or down parallel to the grid until the points representing the measurements best fit one of the radial lines of the overlay. The label on the radial line indicates the decay rate.

6. **CAUTION**

a. When dealing with overlapping contamination areas, using an "average" **n** value for the overall pattern can lead to serious errors.

b. The reliability of the decay rate calculation depends on the precision of the dose rate readings, the interval over which the readings are taken, and the time over which dose calculations are to be made. That is, the more reliable the dose rate monitoring and the longer the time interval over which they are taken, the longer the time period over which reliable dose calculations can be made. As a rule of thumb, reliable dose calculations can be projected in time ($\mathbf{t_p}$) over a period up to three times as long as the monitoring time interval. For example, for a decay rate determined from monitoring readings taken between H+4 and H+8, dose calculations could be reliably projected from H+8 to H+20 ($\mathbf{t_p}$ = H+8 + 3 (* (8 - 4)) = H+20). Thus, the calculations based upon decay rate are valid for 20 hours after the burst. This information should be placed on the contamination overlay to advise the user of the length of time the calculations are valid.

0809. Determination of the Dose Rate for an Arbitrary Time

1. Mathematical Method (see AEP-45, Appendix D-19).

2. Graphical Method.

a. To determine the dose rate at an arbitrary time it is necessary to use a reference dose rate for the reference times H+1 and H+48.

b. The following equation is used for this purpose:

$$R_n = NF \times R_t$$

n is the normalised time, e.g. 1 or 48, and **t** is the time elapsed since the burst.

3. The normalising factors **NF** can be tabulated as shown in the Table in Figure A-XVIII of Annex A or presented graphically as shown in Figure A-XIX of Annex A. The dose rate at H+1 hours can also be determined by using one of the nomograms in Figure A-XX through A-XXXVIII of Annex A, given a dose rate reading at H+t.

4. When working with aerial or ground survey data, an additional step reduces the number of required calculations. Multiply the normalising factor either with the air-ground correlation factor (**AGCF**) for aerial surveys or the vehicle correlation factor (**CF**) to determine the overall correction factor (**OCF**) before applying the correction to the measured data to normalise it to the reference time desired (e.g. when preparing reports).

0810. Determination of the Time at which a given Dose Rate is to be Expected

1. Mathematical Method (see AEP 45, Appendix D-19).

2. **Graphical Method**. When the decay rate and the normalised dose rate for H+1 are known, the dose rate at H+t, or the time t, when a specific dose R_t will occur, can be read from the nomograms shown in Figures A-XX through A-XXXVIII of Annex A.

0811. Total Dose Reduction

1. The primary objective of the commander is to accomplish the mission while keeping the total dose as low as possible. The total dose may be reduced in several ways.

a. Avoid the area. When the actual measured fallout area cannot be avoided, select the route, which has the lowest dose rate. Commit the fewest number of personnel possible to the operation.

b. Reduce exposure time. Plan operations to minimise time spent in contaminated areas. Select the route easiest to cross. This route should offer high speed advance.

c. Delay time of entry. If possible, allow the contamination to decay, refer to the nomograms in Figure A-XX through A-XXXVIII of Annex A for details.

d. Use shielding. All vehicles should have increased shielding. Cross fallout areas on foot as a last resort.

0812. Total Dose Procedures

1. Mathematical Method (see AEP-45, Appendix D-19).

2. Nomogram Method.

a. Total dose, time of entry, and time of stay calculations in fallout areas may also be solved with total dose nomograms. These nomograms may be based on different anticipated decay rates. The respective nomograms are at Figure A-XXXIX through A-LVII of Annex A.

b. Total dose nomograms relate total dose, H+1 dose rate, stay time $\mathbf{T_s}$, and entry time $\mathbf{T_e}$. The index scale is a pivoting line. It is used as an intermediate step between **D** and $\mathbf{R_1}$, and $\mathbf{T_s}$ and $\mathbf{T_e}$. The index scale value can be used to multiply the $\mathbf{R_1}$ to find the **D**. The four values on these nomograms are defined below:

D = total dose in cGy.
$\mathbf{R_1}$ = dose rate in cGy/h one hour after burst (H+1).
The H+1 dose rate must **ALWAYS** be used. **NEVER** use a dose rate taken at any other time.
$\mathbf{T_s}$ = stay time in hours.
$\mathbf{T_e}$ = entry time (hours after H-hour).
$\mathbf{R_1}$ must be known before the total dose nomograms can be used. If any two of the other three values are known, the nomograms can be used to find the missing piece of information. Determination of $\mathbf{R_1}$ is discussed in para 809.
D and $\mathbf{R_1}$, or $\mathbf{T_s}$ and $\mathbf{T_e}$ are used together.
When working with total dose nomograms, start the problem on the side of the nomogram where the two known values are located. If **D** and $\mathbf{R_1}$ are given, start on the left side. If $\mathbf{T_s}$ and $\mathbf{T_e}$ are given, start on the right side. Never begin a problem by joining **D** or $\mathbf{R_1}$ with either of the time values.

c. Example:

Given: $\mathbf{R_1}$ = **200 cGy/h.**
$\mathbf{T_e}$ = **H + 1.5 hours.**
$\mathbf{T_s}$ = **1 hour.**
n = **1.2**

Find: D

Answer: 90 cGy.

Solution.
Select the **n** = 1.2 total dose nomogram. Connect H + 1.5 hours on the $\mathbf{T_e}$ scale with the $\mathbf{T_s}$ reading of 1 hour. Pivot the hairline at its point of intersection with the index scale to the 200 cGy/h on the $\mathbf{R_1}$ scale. Read **D** = 90 cGy on the total dose scale.

d. By 25 hours after the burst, the change in the rate of decay is so low that it is relatively insignificant. Therefore, a different approach is used to estimate total dose when $\mathbf{T_e}$ is greater than 25 hours. In this case, simply multiply the dose rate at the time of entry by the time of stay. This is written:

D	**=**	$\mathbf{R_{Te} * T_s}$
D	**=**	**total dose (cGy).**
$\mathbf{R_{Te}}$	**=**	**dose rate (cGy/h) at time of entry.**
$\mathbf{T_s}$	**=**	**time of stay (h).**

For example:

Given:	$\mathbf{R_1}$	**=**	**300 cGy/h.**
	$\mathbf{T_s}$	**=**	**2 hours.**
	$\mathbf{T_e}$	**=**	**H + 30 hours.**
	n	**=**	**1.2**

Find: **D**

Answer: **10 cGy.**

Solution.
Select the 1.2 decay rate nomogram. Align 300 cGy/h on the $\mathbf{R_1}$ scale with 30 hours on the $\mathbf{T_e}$ scale. Read the dose rate at the time of entry on the $\mathbf{R_t}$ scale (the $\mathbf{R_{Te}}$) as 5 cGy/h.

Find dose $\mathbf{D = R_{Te} * T_s}$

5 cGy/h. * 2 hours

D = 10 cGy.

When $\mathbf{T_s}$ must be calculated against a dose limit, the above formula must be rearranged.

$$T_s = \frac{D}{R_{Te}}$$

Using the data from the previous problem, this is solved as:

$$T_S = \frac{D}{R_{Te}} = \frac{10}{5}$$

$$T_S = 2\,hours$$

Note that the dose rate at the time of entry is used here. Get the time of entry by determining the time the $\mathbf{R_1}$ value will decay to the $\mathbf{R_t}$ value.

Using the data from the two previous examples:

$$R_{Te} = \frac{D}{T_S} = \frac{10}{2}$$

$$R_{Te} = 5$$

Now determine when (time) 300 cGy/h will reduce to 5 cGy/h. Align the $\mathbf{R_1}$ value and the $\mathbf{R_t}$ value. Note that the hairline crosses the time (**t**) scale at H + 30 hours. Therefore, $\mathbf{T_e}$ = H + 30 hours.

0813. Crossing a Fallout Area

1. In nuclear warfare, it is to be expected that extensive areas will be residually radioactive. It may be necessary to cross an area where there is residual radiation.

2. When crossing a contaminated area, the dose rate will increase as the centre of the Area is approached and will decrease as the far side is approached. Therefore, determine an average dose rate for total dose calculations. A reasonable approximation of the average dose rate can be determined using only one half of the highest dose rate. This is written:

$$R_{avg} = \frac{R_{\max}}{2}$$

R_{avg} = average dose rate.

R_{max} = highest dose rate encountered or expected to be encountered.

3. This calculation is sufficient when looking for a suitable route for crossing a contaminated area or when time is critical. A more exact solution for this problem is given in AEP-45, Appendix D-19.

4. The effective dose rate for a crossing problem can be treated like the dose rate for a fixed point. Therefore all follow on calculations (e.g. accumulated dose, earliest

time of entry) for the crossing problem can be done using the same procedures used for a fixed point described in the above.
5. The transmission factor must also be applied as in a stationary situation.

0814. Optimum Time of Exit from Fallout Areas

1. Radiological fallout may present a serious hazard to units that remain in the contaminated area. Shelters such as field emplacements are the best protective measures against nuclear radiation for troops in the field. If the shelter provides any appreciable amount of protection, it will be advantageous to remain and improve it rather than to evacuate to an uncontaminated area. If the situation permits, and higher HQ's approve, the commander may decide to move out of the contaminated area. By evacuating at the optimum exit time, the radiation dose to personnel is kept to a minimum.

2. To compute the optimum exit time from a fallout area, you must know the time of detonation, the location of an uncontaminated area, the average **TF**, and the time required to evacuate.

3. When moving from an area contaminated by fallout, the unit moves into an uncontaminated location. This will necessitate waiting until fallout is complete at present positions.

4. The average **TF** of the fallout shelters and the vehicles used to leave the contaminated area must be computed. Since all shelters are not the same, an average value should be used. The **TF** of a vehicle may be estimated. A unit moving on foot will be fully exposed and will have a **TF** of 1.0.

5. The time to load vehicles and move out of the contaminated area must be estimated. In order to minimise exposure time, it may be necessary to temporarily abandon non essential items and recover them at a later time when the dose rate has decreased to an acceptable value.

6. The optimum time of exit ($\mathbf{T_{opt}}$) is calculated as:

$$T_{opt} = MF \times T_{ev}$$

where:

MF is a multiplication factor taken from Figure A-LVIII of Annex A.
$\mathbf{T_{ev}}$ is the time required to evacuate the contaminated area.
The following abbreviations are used in the optimum time of exit calculations:

$\mathbf{T_{FS}}$	=	Average **TF** for the fallout shelters.
$\mathbf{T_{FM}}$	=	Average **TF** after leaving shelters (during movement out of the contaminated area).
$\mathbf{TF_{Ratio}}$ =	**TF** ratio.	

Compute the optimum exit time by the three following steps:

- Calculate the **TF** ratio, $\mathbf{TF_{Ratio} = T_{FS}/T_{FM}}$.
- Determine the multiplication factor. Enter the vertical axis of Figure A-LVIII of Annex A with the value obtained for $\mathbf{TF_{Ratio}}$. Move horizontally along this value to the curve. Move straight down and read the multiplication factor from the horizontal axis.
- Calculate the optimum exit time. Multiply the multiplication factor by $\mathbf{T_{ev}}$. The product is the optimum time, in hours after detonation, that the unit should leave its shelters and evacuates the area.

a. Special Considerations.
The unit should evacuate the fallout area as soon as possible when ratios of $\mathbf{TF_{Ratio}}$ are close to or greater than 0.5.
If the optimum time of exit is estimated to be before the actual arrival of fallout, the unit should evacuate the area as soon as possible after fallout is complete and an uncontaminated area is available.
The unit will receive the smallest dose possible if it leaves the contaminated area at the optimum time of exit. If the commander is willing to accept up to a ten percent increase in dose, he may leave the shelters any time between one half and twice the optimum time of exit.
If possible, personnel should improve their shelters while waiting for the optimum time of exit. The estimate of the optimum time of exit should be recalculated if significant improvement is made in the shelters. Improved shelters mean the unit should remain in shelters for a longer period of time to minimise the dose to the personnel.

Sample Problem.

Given: $\mathbf{T_{FS}}$ = **0.1 (foxhole).**

$\mathbf{T_{FM}}$ = **0.6 (2½ ton truck).**

$\mathbf{T_{ev}}$ = **1 hour.**

Find: **Optimum time of exit.**

Solution: $\mathbf{TF_{Ratio}}$ = **0.1/0.6 = 0.167**

Multiplication factor = **2.80**

Optimum time of exit = **MF * $\mathbf{T_{ev}}$ = 2.80 * 1 h**

= **2.80 h**

or 2 hours and 48 minutes.

0815. Induced Radiation

1. Neutrons are produced in all nuclear weapon bursts. Some of these neutrons may be captured by the various elements in the soil under the burst. As a result, these elements become radioactive, emitting beta particles and gamma radiation for an extended period of time. Beta particles are a negligible hazard unless the radioactive material makes direct contact with the skin for an extended period of time. Beta particles can cause skin irritations varying from reddening to open sores. In contrast, gamma radiation readily penetrates the body and can cause radiation injury and even death. To determine the external military hazard posed by induced radiation, an analysis of the dose rate of the emitted gamma radiation must be determined.

2. The location of a suspected induced radiation area created by an air burst is determined by nuclear burst data. Weather conditions have no influence upon its location or size. Surface winds will not affect the pattern. The pattern, if produced, will always be around GZ. The size of the pattern depends on the yield of the weapon and height of burst. Figure 8-III shows the boundaries of the induced area for different yields. Assuming an optimum height of burst, the user enters the table with the yield of the weapon (or interpolates if not listed). The distance given is the maximum horizontal radius to which a 2 cGy/h dose rate will extend one hour after burst.

Estimated Yield (KT)	**2 cGy/h dose rate at H + 1 hour Horizontal Radius (meters)**
0.1	**200**
1	**700**
10	**1000**
100	**1600**
1000	**2000**

Figure 8-III, Radii of Induced Contamination.

3. The circular area with a radius as given in Figure 8-III around GZ is regarded as contaminated until actual dose rate readings indicate otherwise. The actual area of contamination is usually substantially less, depending upon actual yield and height of burst.

0816. Decay of Induced Radiation

1. The soil in the target area is radioactive to a depth of 0.5 metres at GZ. In contrast, fallout is a deposit of radioactive dust on the surface. From this it can be seen that decontamination of the area is impractical.

2. The decay characteristics of induced radiation are considerably different from those of fallout. Fallout is a mixture of many substances, all with different rates of decay. Induced radiation is produced primarily in aluminium, manganese, and sodium.

3. Other elements, such as silicon, emit so little gamma radiation or decay so fast that they are less important.

4. During the first 30 minutes after a burst, the principal contributor to induced radiation is radioactive aluminium. Almost all soils contain aluminium. It is one of the most abundant elements in the earth's surface. Radioactive aluminium has a half-life of two to three seconds. Because of this, almost all the radioactive aluminium has decayed within 30 minutes after the burst.

5. Most soils also contain significant quantities of manganese. This element decays with a half-life of about 2.6 hours. From 30 minutes after burst until 10 to 20 hours after the burst, both manganese and sodium are the principal contributors to the radiation. After 10 to 20 hours after the burst, sodium, which decays with a half-life of about 15 hours, is the principal source of radiation.

6. Soil composition is the most important factor in the decay of induced radiation. Its decay must be considered differently from that of fallout. For fallout, the decay rate is calculated by using the Kaufmann equation. For induced radiation, the percentage, by weight, of elements present in the soil determines the decay rate.

7. Since soil composition varies widely, even in a localised area, you must know the actual chemical composition of the soil to determine the rate of decay of induced radiation. The soils are divided into four types. Figure 8-IV has been extracted from Defense Nuclear Agency Effects Manual 1 (DNA EM-1).

8. Since the actual soil composition will not be known, soil type II, the slowest decay, is used for all calculations until the NBC Centre advises use of a different soil type.

Element	Type I (Liberia, Africa)	Type II (Nevada Desert)	Type III (Lava, Clay, Hawaii)	Type IV (Beach, Sand, Pensacola, Florida)
	Chemical Composition of Soils			
Sodium	-	1.30	0.16	0.001
Manganese	0.008	0.01	2.94	-
Aluminium	2.89	6.70	18.79	0.006
Iron	3.75	2.20	10.64	0.005
Silicon	33.10	32.00	10.23	46.65
Titanium	0.39	0.27	1.26	0.004
Calcium	0.08	2.40	0.45	-
Potassium	-	2.70	0.88	-
Hydrogen	0.39	0.70	0.94	0.001
Boron	-	-	-	0.001
Nitrogen	0.065	-	0.26	-
Sulphur	0.07	0.03	0.26	-
Magnesium	0.05	0.60	0.34	-
Chromium	-	-	0.04	-
Phosphorus	0.008	0.04	0.13	-
Carbon	3.87	-	9.36	-
Oxygen	50.33	50.82	43.32	53.332

Figure 8-IV, Soil Types for Induced Radiation Calculations.

9. Soil type is determined by using engineer soil maps or a NBC 4 report and the induced decay nomograms. The method is basically a process of elimination. The dose rate and the time it was measured are applied to an induced decay nomogram. This will result in an H+1 or $\mathbf{R_1}$ dose rate. Then if the other dose rates and times from the series report result in the same $\mathbf{R_1}$ dose rate, that is the soil type. If not, check the other nomograms until the one used results in the same $\mathbf{R_1}$.

0817. Dose Rate Calculations

1. The decrease in the dose rate must be calculated before total dose can be found. This is done with decay nomograms. Use the residual radiation (induced) decay nomograms in (Figures A-LIX through A-LXII of Annex A) for these calculations. They allow the user to predict the dose rate at any time after the burst. Each nomogram denotes time (hours) after the burst for one of the four soil types.

2. In each nomogram, the $\mathbf{R_1}$ scale is at the right. This scale shows H+1 dose rates. The $\mathbf{R_t}$ scale is on the left. This scale shows dose rates at times **t**.

Example.

Given: R_t = **150 cGy/h at H + 3 hours, soil type II.**

Find: R_1

Answer: **190 cGy/h.**

Solution:
Select nomogram for soil type II. Align the hairline with the 3 hour tick mark on the time (middle) scale (**t**) and the 150 cGy/h point on the R_t scale. Read the dose rate as 190 cGy/h at the point of intersection with the R_1 scale.

0818. Total Dose Calculations

1. The nomogram in Figure A-LXIII of Annex A is used for predicting the total dose received in an induced area. This nomogram relates total dose, H + 1 dose rate, stay time, and entry time. The two scales to the left of the index line show total dose and H + 1 dose rate. There are two stay time scales to the right of the index line. The extreme right scale shows entry time. The index line is a pivoting line, which is used as an intermediate step between **D** and R_1. R_1 is found by using one of the induced decay nomograms. If soil type is unknown, assume the soil is type II. The total dose nomogram, Figure A-LXIII of Annex A, is **NEVER** used to find R_1.

2. On Figure A-LXIII of Annex A, soil types II and IV under "stay time" will be used for total dose calculations if the soil type is not known. If the soil type is known, the appropriate scale under "stay time" will be used. It is possible to find any one value on the total dose nomogram if the other three are given, as illustrated in the following examples.

Example 1.

Given: R_1 = **140 cGy/h.**
T_e = **H + 6 hours.**
T_s = **1 hour.**

Soil type: **II**

Find: **D**

Answer: **72 cGy.**

Solution.
On nomogram at Figure A-LXIII of Annex A, connect H + 6 on the T_e scale with 1 hour on the T_s scale (soil types II and IV) with a hairline. Pin the hairline at the point of intersection with the index scale. Now pivot the hairline to 140 cGy/h on the R_1 scale. Read 72 cGy on the **D** scale.

Example 2.

Given: **R_1 = 300 cGy/h.**
T_e = H + 6 hours.
D = 70 cGy.

Soil Type: III

Find: T_s

Answer: 1 hour.

Solution.
On nomogram at Figure A-LXIII of Annex A, connect 70 cGy on the **D** scale with 300 cGy/h on the **R_1** scale. Pin the hairline at the point of intersection with the index scale. Pivot the hairline to H + 6 hours on the **T_e** scale. Read 1 hour on the **T_s** scale (soil types I and III).

0819. Transmission Factors

1. TF for induced areas are determined in the field. The **TF** in Figure A-XVI of Annex A should be used with the greatest reservation. Actual **TF** in induced areas may be lower by as much as 70 percent because of a very technical characteristic of radiation.

2. Essentially the strength of gamma radiation is measured in million electron volts (MeV). Fallout less than 24 hours old has an average energy of 0.67 MeV. Induced radiation emitted from the three principal soil elements has a range of 0.68 MeV to 1.2 MeV.

3. Because of the unique decay characteristics of induced radiation, **TF** must be recalculated frequently. Every four hours is recommended. This accounts for changes in the penetration ability of the remaining radiation.

0820. Crossing an Induced Radiation Area

1. If an area must be crossed, the lowest dose rate area, consistent with the mission, is selected.

2. In calculating total dose, it is necessary to determine an average dose rate; dose rates increase as the centre of the area is approached and then decrease beyond the centre of the area. The average dose rate represents a mean value the individual is exposed to during the time of stay. A reasonable approximation of the average dose rate can be obtained by dividing by two the maximum dose rate predicted to be encountered. This is written as:

$$R_{avg} = \frac{R_{\max}}{2}$$

3. Time of stay (stay time) must be calculated for crossing problems. Use the relationship of:

$$T_s = \frac{distance}{speed}$$

4. Then follow the same procedures as for fallout.

0821. Plotting Data and Producing a NBC 5 NUC Message.

1. Contaminated areas are shown on the radiological situation map, and information about them must be passed to other units and HQ's. The most expeditious means for this is the radiological contamination overlay.

2. The preparation of such an overlay is described below:

3. After all available information from monitoring and surveying has been plotted on a map as normalised (H+1) and corrected (unshielded ground dose rates) data contour lines for standard dose rates can be drawn on a radiological contamination overlay.

4. When constructing the radiological contamination overlay, there are factors that locally affect the contamination pattern.

5. This is particularly true between points in an aerial survey. These include topographic features such as bluffs or cuts, heavily built-up or wooded areas, and bodies of water. For example, a large river will carry away any fallout landing on it, leaving its path relatively free of contamination. Also, the contamination hazard near a lake will be lower than expected. The fallout particles will sink to the bottom of the lake, and the water will provide shielding. In wooded areas or built-up areas, a measure of the reduction of dose rate can be obtained by using the **TF's** (see Figure A-XVI of Annex A) for these areas.

6. Dose-rate contour lines showing the contamination hazard in an area can be drawn as follows:

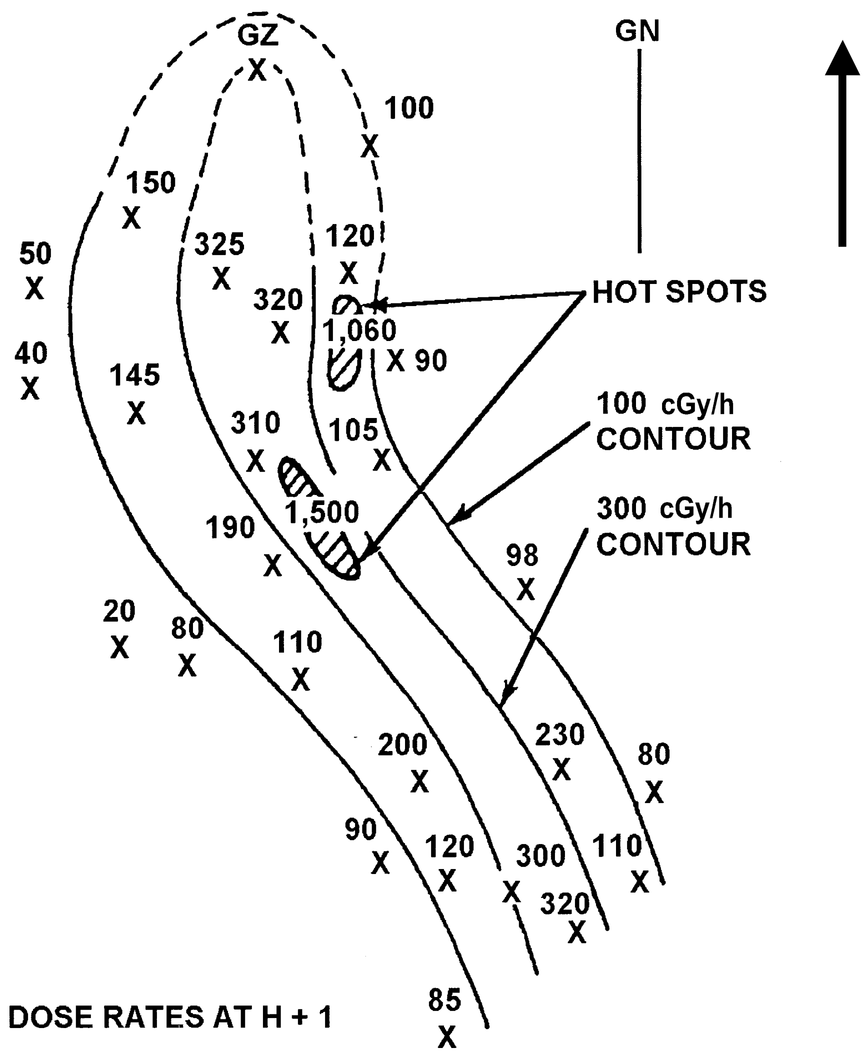
   a. Determine the H+1 dose-rate contour lines to be plotted (for example, 30, 100, 300, 1,000 centigray per hour). These contour lines may be required for NBC 5 purposes or for anticipated calculations to be made from the data.

   b. Determine the points on the chosen survey routes, or on course legs, and close to monitoring locations that are providing the desired dose rates. Interpolate linearly between dose rates as required.

   c. Connect all the points having the same dose rates with a smooth line. Use all plotted monitoring data as additional guides in constructing these contours.

7. The plotter must use care and judgement in plotting these contours and must visualise the probable general shape and direction of the pattern. Any dose rates disproportionately higher than other readings in the immediate area indicate possible hot spots. When such readings are reported, that area should be rechecked. If dose rates are confirmed, these hot spots should be plotted and clearly identified.

Figure 8-V shows a typical plot, which might be developed, from survey data.



Legend:

———————— Actual

- - - - - - - - - - Predicted

Figure 8-V, Fallout Pattern plotted from Survey Data.

8. Radiological contamination overlays used for evaluation purposes must provide the most detailed information possible.

9. The minimum information required is:

a. Map designation and orientation data.

b. Nuclear burst and GZ identification (sets ALFA and FOXTROT of NBC 2).

c. H-hour (set DELTA of NBC 2).

d. Reference time (set OSCAR of NBC 5).

e. Decay rate/soil type.

f. Time of preparation and validity time.

g. Source of the contamination fallout or neutron induced contamination.

h. Standard dose rate contour lines.

10. Additional information such as time of completion lines for fallout may also be included where unit SOPs require such information.

0822. Reporting Data

1. Electronic communications are not always available. If this is the case, the radiological contamination overlay must be converted into a series of readings and co-ordinates for transmission as a NBC 5 NUC report. This method has a disadvantage. It requires the addressee to replot data from the NBC 5 NUC report and connect them to produce dose rate contours; a time consuming process. Staff planners must consider that the shapes of dose rate contours drawn to correspond with a relatively brief series of readings and co-ordinates can vary significantly.

2. If electronic communications of data or communications of hard copy are not available and if time and distance permit, radiological contamination overlays are sent by messenger. Data is transmitted, manually by the NBC 5 NUC report as a last resort.

3. When the contamination comes from a single burst, the dose rates will be normalised to H + 1. But if there have been several detonations at different times and no single H + 1 is possible, then the dose rates are reported for a specific time.

4. On the NBC 5 NUC report a closed contour line on a plot, is represented by repeating the first coordinate.

5. To calculate the dose rates along the contour lines at a later time use the procedures described in para 809, and label the contour lines accordingly. AEP-45 describes methods by which contour lines may be produced using computers.

CHAPTER 9

BIOLOGICAL ATTACKS, PREDICTION AND WARNING OF ASSOCIATED HAZARDS AND HAZARD AREAS

0901. Aim

1. The biological prediction procedure provides information on the location and the extent of the hazard area and the duration of the hazard resulting from attacks with biological weapons.

2. It provides the necessary information for commanders to warn units within the predicted hazard area.

3. Biological agents (BIO) include a variety of micro-organisms and a variety of toxic molecules (TOX) derived from micro-organisms, plants and animals.

0902. Definitions

1. ATTACK AREA. This is the **predicted** area immediately affected by the delivered biological agent.

2. HAZARD AREA. This is the **predicted** area in which unprotected personnel may be affected by agent spreading downwind from the ATTACK AREA. The downwind distance depends on the type of attack and on the weather and terrain in both the ATTACK AREA and the area downwind of the ATTACK AREA.

3. CONTAMINATED AREA. This is the area in which some BIO hazard may, in solid or liquid form, remain at hazardous levels for some time after the attack. The actual shape and duration can only be determined by surveys.

0903. General

1. The prediction of the attack and hazard area is dependent upon:

   a. The type of delivery (and agent container),

   b. The type of attack, and

   c. The meteorological factors.

0904. Means of Delivery

1. The means of delivery and the type of agent container are listed in Annex C, C04.a. and C04.b.

0905. Types of Attacks

1. Attacks can be divided into 4 types:

a. **Type "P"**:
Type P consists of attacks with localised exploding munitions (such as: bomb (BOM), shell (SHL), Rocket (RKT), mine (MNE), surface burst missile (MSL)), surface release spray (SPR) or surface release aerosol generator (GEN).

b. **Type "Q"**:
Type Q consists of attacks with munitions that cover a large area such as: bomblets (BML) or air burst MSL.

c. **Type "R"**:
Type R consists of attacks where the location of the attack is known, but the type of container is unknown (UNK), or the attack was from an air release SPR or GEN.

d. **Type "S"**:
Type S consists of detection after an unobserved attack.

NOTE: A surface release SPR or GEN should be treated as Type "R" if it is mobile and releases material over a distance exceeding 1 km.

0906. Procedures and Constraints

a. **Procedures.**

(1) Record and update the following information:
- Weather information from relevant NBC CDRs, which may contain both forecast data and measured data.
- Weather information from local measurements/observations, which may contain both data before and during the cloud passage period.
- A data base of local meteorology measured during the cloud passage period.

(2) Record terrain features (wooded areas, mountains, plains, etc.) which may influence the direction and speed of biological agent clouds.

(3) A NBC 3 BIO may be generated and considered for distribution whenever a biological attack has taken place. If biological detection equipment is available this report will most likely be generated from one or more NBC 1, 2 or 4 BIO. Otherwise, this report will most likely be generated from one or more NBC 1, 2 or 4 CHEM, where the chemical agent is unknown.

(4) Estimate the meteorological parameters for the attack area and the predicted downwind hazard area, on receipt of a NBC 1 or NBC 2 BIO with agent UNK, BIO or TOX, or a NBC 4 BIO with agent BIO or TOX.

(5) Select, in accordance with national directives, the weather information to be used, and calculate the predicted downwind hazard area.

b. **Constraints.**

(1) When calculating the predicted downwind hazard area from biological attacks, many factors will affect the accuracy of the prediction. Some of these factors are:
Type of and amount of biological agent(s); Type of and amount of delivery system(s); Type and amount of agent container(s); Terrain composition; Weather (rain, clouds, etc.); Air stability; Type of surface(s); Vegetation(s); Surface air temperature; Relative humidity, and changes to these factors.

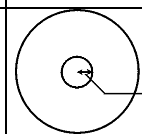
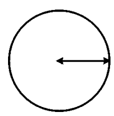
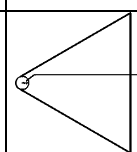
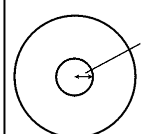
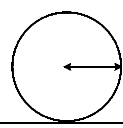
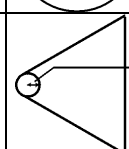
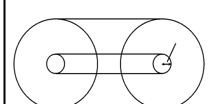
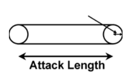
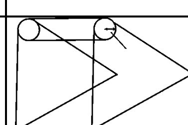
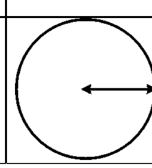
(2) Some of these factors are not considered when using the procedures in this chapter, unless evaluated and estimated manually by the operator.

(3) The procedure shown in this chapter is based on the limited amount of information available at the time of attack.

(4) To be able to make more accurate predictions, more information about the listed factors has to be available, and more sophisticated methods have to be used for prediction. Such procedures are described in AEP-45, Appendices D-12 and D-14.

0907. Types and Cases of Biological Attacks. (NOT TO SCALE)

1. For training and exercises the radius of attack area for Chemical Type “A” from para 1207 may be used.

TYPE OF AGENT CONTAINER	RADIUS OF ATTACK AREA *	WIND SPEED	TYPE **	CASE	FIGURE
BOM, RKT, SHL, MNE, Surface Burst MSL, Surface Release SPR or GEN	**= 2 km**	**≤ 10 KPH**	**P**	**1**	
		**> 10 KPH**		**2**	
BML, Air Burst MSL	**= 10 km**	**≤ 10 KPH**	**Q**	**1**	
		**> 10 KPH**		**2**	
Air release SPR and GEN, UNK	**= 2 km**	**≤ 10 KPH**	**R**	**1**	
	 **100 km default**	**> 10 KPH**		**2**	
Detection after unobserved attack (NBC 4 BIO message)	**= 50 km**		**S**	**1 / 2**	

Note: A NBC 1 may be received after an unobserved attack and should be treated as a NBC 4.

*** A different observed radius may be specified in GENTEXT.**

****	If two types of attack are found, use the following order to determine which type of attack to use: Type "R", Type "Q", or Type "P".**

0908. Biological Hazard Areas

1. The hazard area is generated in three steps: 1. The initial hazard area (paras 911 and 912), 2. The ‘first CDR’ hazard area (para 913) and 3. The ‘beyond first CDRs’ hazard area (para 914).

2. Biological agents (BIO or TOX) will create initial hazard areas similar in appearance to those for chemical attacks (para 1211). The initial hazard area for a biological line source will also be similar to that for a chemical line source (paras. 1212.e. and 1212.f.).

3. Computations for the biological hazard area for changes in meteorological conditions for all types are similar to the recalculation procedures provided in para 1214 for chemical attacks. However, biological agents will generally remain toxic through multiple changes in meteorological conditions and multiple NBC CDMs. Therefore, the recalculation procedures must be performed more than once. The procedures in this chapter are to be used for hazard estimation over both land and water.

0909. Attack Areas

1.The attack area for type “**P**” is drawn as a circle of radius from para 907, centred at the release location.

2. The attack area for Type "**Q**" is drawn as a circle of radius from para 907, centred at the release location.

3. The attack area for Type "**R**" is defined by the line end points entered as two positions in set FOXTROT.
In case of only one position reported in set FOXTROT, the line has the default attack length from (para 907) and is drawn centred on this point and oriented in the direction of the aircraft trajectory.
A circle of radius (para 907) is drawn at the two end positions, with tangents connecting the two circles together. If the flight direction cannot be established, assume it to be perpendicular to the wind direction.

4. The attack area for Type "**S**" is drawn as a circle of radius (para 907), centred at the detection location. The attack area is unknown; this is only an initial area.

5. The attack area for Types "**P**", "**Q**" or "**R**" may be reduced or enlarged based on available information specified in GENTEXT. In computer generated messages this information will be formatted as: RDS:XXXKM, always using three digits for the radius, e.g. RDS:045KM.

0910. Downwind Travel Distances for the Initial Period

1. The downwind travel distance is defined as the distance travelled by the centre of the cloud. The downwind travel distance is broken into three segments corresponding to the next time periods of the NBC CDR:

$$d_1 = u_1 \bullet t_1$$

$$d_2 = 2u_2$$

$$d_3 = u_3 \bullet (4 - t_1)$$

d_1 = distance in km travelled within the NBC CDR 2 hour period containing the attack.

d_2 = distance in km travelled within the next NBC CDR 2 hour period.

d_3 = distance in km travelled within the third NBC CDR 2 hour period.

u_1 = wind speed in KPH for the NBC CDR 2 hour period containing the attack.

u_2 = wind speed in KPH for the next NBC CDR 2 hour period.

u_3 = wind speed in KPH for the third NBC CDR 2 hour period.

t_1 = decimal hours remaining after the attack or detection within the NBC CDR 2 hour period of validity corresponding to the attack.

2. For any NBC CDR time periods where the wind speed is less than 10 KPH, a value of 10 KPH should always be used for computations.

a. If the attack or detection occurs in the first NBC CDR time period, 3 downwind distances are calculated; $\mathbf{d_1}$ using the first NBC CDR time period, $\mathbf{d_2}$ using the second NBC CDR time period, and $\mathbf{d_3}$ using the third NBC CDR time period. which is extended to include the duration in the first time period before the attack occurs to result in 6 hours total time.

b. If the attack or detection occurs in the second NBC CDR time period, 2 downwind distances are calculated; $\mathbf{d_1}$ using the NBC CDR time during the period of attack/detection, $\mathbf{d_2}$ using the third NBC CDR time period, which is extended to include the duration in the second time period before the attack occurs plus two hours to result in 6 hours total time.

c. If the attack or detection occurs in the third NBC CDR time period, only $\mathbf{d_1}$ can be calculated, which is computed using 6 hours total time.

3. The total downwind distance (**DA**) of the centre of the bio cloud is the sum of the three distances:

$$DA = d_1 + d_2 + d_3$$

DA = total downwind distance in km.

4. The leading and trailing edges for the current NBC CDR should also be computed based on the downwind distance path, using factors of 1.5 and 0.5, respectively:

$$DL = 1.5DA$$
$$DT = 0.5DA$$

DL = leading edge distance in km.
DT = trailing edge distance in km.

5. For plotting the hazard area for the current NBC CDR, the third time period must be extended to include the leading edge:

$$DE = DL - d_1 - d_2$$

DE = extended distance in km travelled within the third NBC CDR 2 hour period.

0911. Types of Initial Hazard Areas

1. This paragraph outlines the procedures and calculations that are to be followed for all BIO cases. The next paragraph (912) gives the step by step procedures for each of the cases.

a. Case “**1**” attacks.

(1) The wind speed is 10 KPH or less, so a wind speed of 10 KPH should be used.

(2) The radius of the hazard area circle equals the attack area radius plus the product of a wind speed of 10 KPH, times the time in hours remaining after the attack or detection in the corresponding CDR time period. For example a Type “P”, Case “1” attack having a 2 hour travel duration, the hazard area radius equals (Radius + 2 x 10).

(3) A single hazard area circle will result for Types “**P**”, “**Q**” and “**S**”. The area within this circle represents the hazard area.

(4) Two circles are drawn for Type “**R**” with tangents drawn between the hazard area circles. The total enclosed area represents the hazard area.

(5) A value of zero is used for the downwind distance path, leading edge, and trailing edge computations for Case “**1**” attacks, since the wind direction is considered variable. The leading edge can be considered to be the edge of the hazard area circle.

b. Case “**2**” attacks “P”, “Q” and “R” types.

(1) Draw a line through the centre of the attack area circle oriented in the downwind direction. For a Type “**R**” release pick one of the attack area circles. The line should extend distance $\mathbf{d_1}$ in the downwind direction from the centre of the circle. In the upwind direction along the same line mark a distance equal to twice the attack circle radius.

(2) Draw a line perpendicular to the downwind direction line at the downwind distance ($\mathbf{d_1}$) extending in both directions.

(3) Draw two tangent lines to the attack circle from the upwind point marked extending until they intersect with the perpendicular line. These lines will form a 30 degrees angle on either side of the downwind direction line.

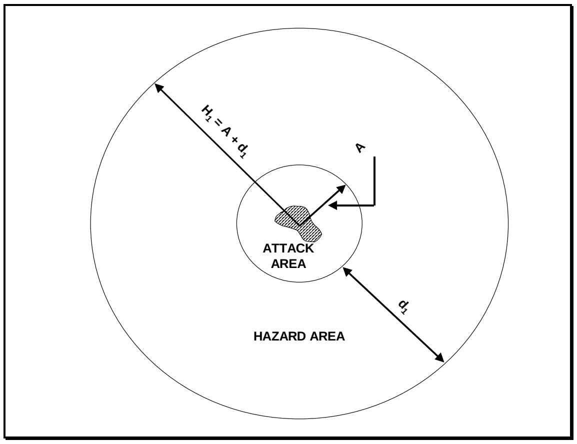
(4) For a Type “**R**” release repeat this procedure for the other attack area circle, and connect the lower hazard area corners to enclose the combined downwind hazard area.

(5) For a Type “**S**” release, there is no hazard area plotted because the location and time of the release are unknown. A circle of the attack area radius defines an area where there is a risk of being exposed to the biological agent. Informing friendly units throughout the area of this risk should be considered. Before a hazard prediction can be carried out, reports are required from units in the area or survey teams can be sent out. Once more information about the attack has been obtained, type “S” attacks should then be treated as either type “**P**”, “**Q**” or “**R**”.

c. Multiple FOXTROT locations should be addressed individually by computing each downwind hazard area. The outer boundaries should be connected as with the chemical attacks (paras 1212.e. and 1212.f.). Examples are shown in Chapter 12, Figures 12-VIII and 12-XIII. Computer generated hazard areas for multiple FOXTROT locations may appear somewhat different.

0912. Prediction of the Initial Hazard

a. Type "P", Case "1".



A = radius of attack area
H_1 = radius of hazard area
d_1 = downwind travel distance in the CDR time period
t_1 = time remaining from attack in the CDR time period
u_1 = wind speed (10 KPH)

$H_1 = A + d_1$
$d_1 = u_1 \cdot t_1$

Figure 9-I. Type “P”, Case “1”

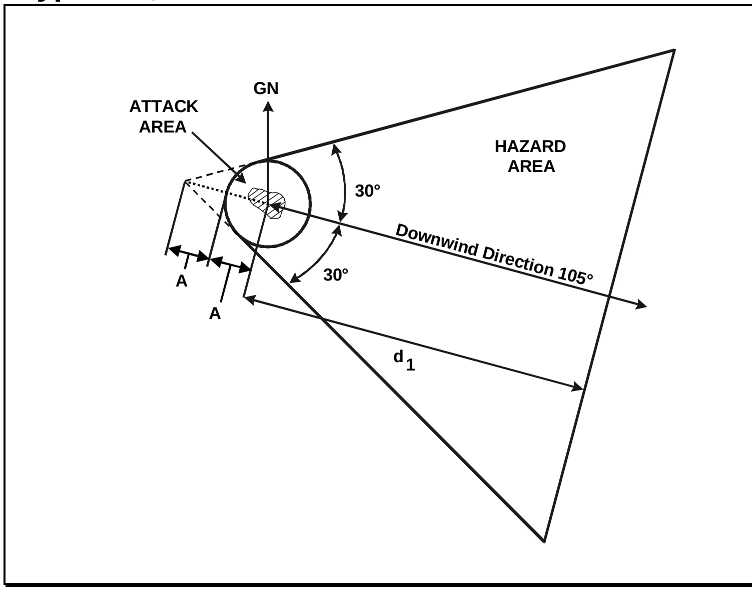
(1) Obtain the location of the attack from the relevant NBC BIO message(s) (set FOXTROT) and plot it on the map. (Figure 9 - I).

(2) Draw a circle with the attack area radius (A), around the centre of the attack location. The area within this circle represents the attack area.

(3) Draw a circle with a radius (H_1) that equals the radius of the attack area plus the downwind travel distance (d_1). Distance d_1 is equal to the wind speed (u_1) for the CDR time period, times the remaining time (t_1) from the attack within that CDR time period. For Type “**P”**, Case “1”, a wind speed of 10 KPH is assumed. This circle will represent the hazard area.

(4) Prepare and transmit an NBC 3 BIO to units and installations in the predicted hazard area in accordance with SOPs. (Figure 9 - I).

b. Type "P", Case "2".



A = radius of attack area
d_1 = downwind travel distance in the CDR time period
t_1 = time remaining from attack in the CDR time period
u_1 = wind speed

$d_1 = u_1 \cdot t_1$

Figure 9-II. Type “P”, Case “2”

(1) Obtain the location of the attack from the relevant NBC BIO message(s) (set FOXTROT) and plot it on the map. (Figure 9 - II).

(2) From the centre of the attack location, draw a Grid North line (GN Line).

(3) Draw a circle with the attack area radius around the centre of the attack location. The area within this circle represents the attack area.

(4) Using the valid NBC CDM, identify the downwind direction and the downwind speed.

(5) From the centre of the attack area, draw a line showing the downwind direction.

(6) Determine the Downwind Travel Distance, d_1. (See para 910.a.) If d_1 is less than the attack area radius set it equal to the attack area radius.

(7) Plot the downwind travel distance from the centre of the attack area on the downwind direction line.

(8) From the downwind travel distance, draw a line perpendicular to the downwind direction line. Extend the line to either side of the downwind direction line.

(9) Extend the downwind direction line twice the attack area radius upwind from the centre of the attack area.

(10) From the upwind end of this line, draw 2 lines, which are tangents to the attack area circle, and extend them until they intersect with the perpendicular to the downwind direction line. (See (8) above). These lines will form a 30° angle either side of the downwind direction line.

(11) The hazard area is taken to be the area bounded by:

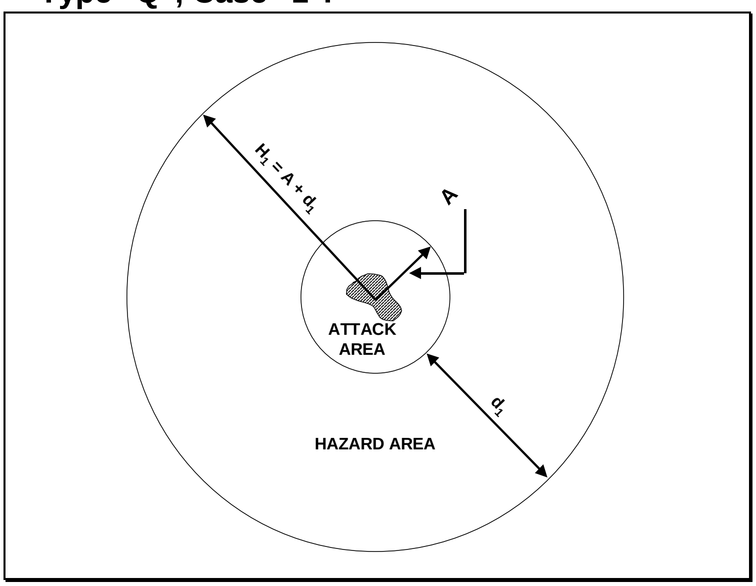
(a) The upwind edge of the attack area circle.

(b) The two 30° tangents.

(c) The perpendicular to the downwind direction line. See Figure 9 - II.

(12) Prepare and transmit an NBC 3 BIO to units and installations in the predicted hazard area in accordance with SOPs. (Figure 9 - II).

c. Type "Q", Case "1".



A = radius of attack area
H_1 = radius of hazard area
d_1 = downwind travel distance in the CDR time period
t_1 = time remaining from attack in the CDR time period
u_1 = wind speed (10 KPH)

$H_1 = A + d_1$
$d_1 = u_1 \cdot t_1$

Figure 9-III. Type "Q", Case "1"

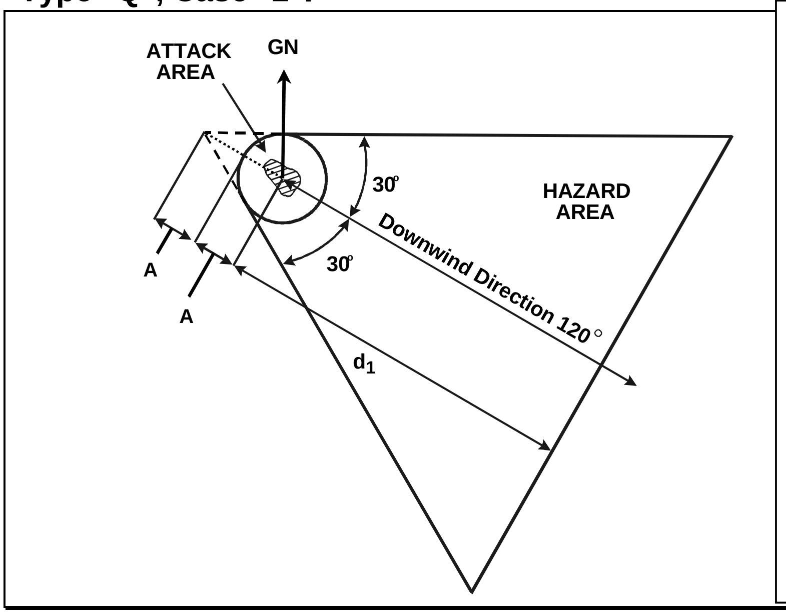
(1) Obtain the location of the attack from the relevant NBC BIO message(s) (set FOXTROT) and plot it on the map. (Figure 9 - III).

(2) Draw a circle with the attack area radius around the centre of the attack location. The area within this circle represents the attack area.

(3) Draw a circle with a radius equal to the distance d_1 (10 KPH times the travel duration) plus the radius of the attack area. This circle will represent the hazard area.

(4) Prepare and transmit a NBC 3 BIO to units and installations in the predicted hazard area in accordance with SOPs.

d. Type "Q", Case "2".



A = radius of attack area
d_1 = downwind travel distance in the CDR time period
t_1 = time remaining from attack in the CDR time period
u_1 = wind speed

$$d_1 = u_1 \cdot t_1$$

Figure 9-IV. Type "Q", Case "2"

(1) Obtain the location of the attack from the relevant NBC BIO message(s) (set FOXTROT) and plot it on the map. (Figure 9 - IV).

(2) From the centre of the attack location, draw a Grid North line (GN Line).

(3) Draw a circle with the attack area radius, around the centre of the attack location. The area within this circle represents the attack area.

(4) Using the valid NBC CDM, identify the downwind direction and the downwind speed.

(5) From the centre of the attack area, draw a line showing the downwind direction.

(6) Determine the Downwind Travel Distance, d_1 (See para 910.a.). If d_1 is less than the attack area radius set it equal to the attack area radius.

(7) Plot the downwind travel distance from the centre of the attack area on the downwind direction line.

(8) From the downwind travel distance, draw a line perpendicular to the downwind direction line. Extend the line to either side of the downwind direction line.

(9) Extend the downwind direction line twice the attack area radius upwind from the centre of the attack area. This is equal to twice the radius of the attack area.

(10) From the upwind end of this line, draw 2 lines that are tangents to the attack area circle, and extend them until they intersect with the perpendicular to the downwind direction line. (See (8) above). These lines will form a 30° angle either side of the downwind direction line.

(11) The hazard area is taken to be the area bounded by:

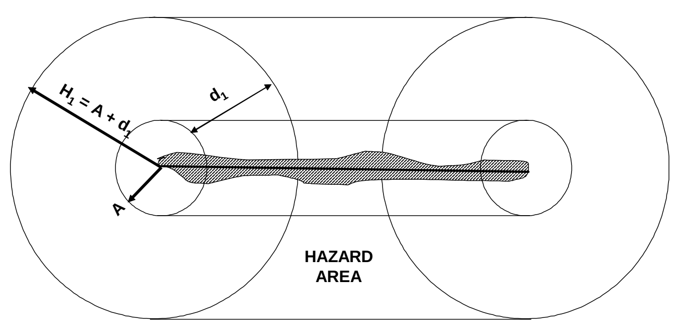
(a) The upwind edge of the attack area circle.

(b) The two 30° tangents.

(c) The perpendicular to the downwind direction line. See Figure 9 - IV.

(12) Prepare and transmit an NBC 3 BIO to units and installations in the predicted hazard area in accordance with SOPs. (Figure 9 - IV).

e. Type "R", Case "1".



A = radius of attack area
H_1 = radius of hazard area
d_1 = downwind travel distance in the CDR time period
t_1 = time remaining from attack in the CDR time period
u_1 = wind speed (10 KPH)

$H_1 = A+d_1$
$d_1 = u_1 \times t_1$

Figure 9-V. Type “R”, Case “1”

(1) Obtain the locations of the attack end points from the relevant NBC BIO message(s) (set FOXTROT) and plot them on the map. Connect the end points to form the attack line.

(2) Draw a circle with the attack area radius around each end point.

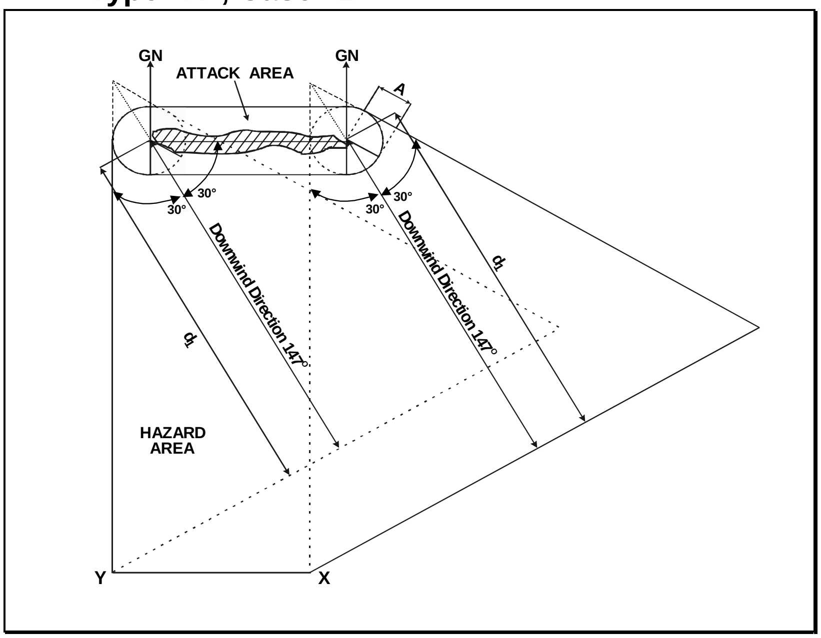
(3) Connect these circles on both sides by drawing tangents to the circles parallel to the attack line, to designate the attack area.

(4) Draw a circle with a radius equal to the distance d_1 (10 KPH times the travel duration) plus the radius of the attack area.

(5) Connect these circles on both sides by drawing tangents to the circles parallel to the attack line, to designate the hazard area (Figure 9 - V).

(6) Prepare and transmit a NBC 3 BIO to units and installations in the predicted hazard area in accordance with SOPs. (Figure 9 – V).

f. Type "R", Case "2".



A = radius of attack area
d_1 = downwind travel distance in the CDR time period
t_1 = time remaining from attack in the CDR time period
u_1 = wind speed

$\dot{d}_1 = \dot{u}_1 \cdot t_1$

Figure 9-VI. Type "R", Case "2".

(1) Obtain the locations of the attack end points from the relevant NBC BIO message(s) (set FOXTROT) and plot them on the map. Connect the end points to form the attack line.

(2) Draw a circle with the attack area radius around each point.

(3) Connect these circles on both sides by drawing tangents to the circles parallel to the attack line, to designate the attack area.

(4) Draw a Grid North line from the centre of each circle.

(5) Using the valid NBC CDM, identify the downwind direction and the downwind speed.

(6) From the centre of each attack area circle, draw a line showing the downwind direction.

(7) Determine the Downwind Travel Distance, d_1 (See para 910.a.).

(8) Plot the downwind travel distance from the centre of each attack area circle on the downwind direction lines.

(9) From the downwind travel distance, draw a line perpendicular to each of the downwind direction lines. Extend the lines to either side of the downwind direction lines.

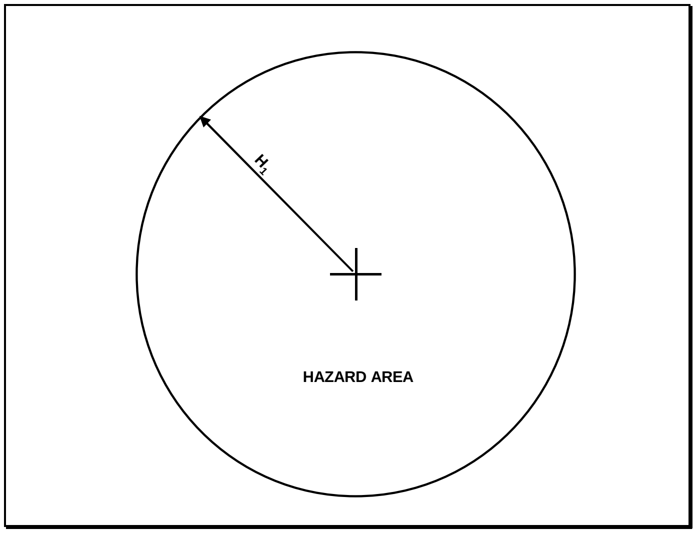
(10) Extend the downwind direction lines twice the attack area radius upwind from the centre of each attack area circle.

(11) From the upwind end of each line, draw 2 lines, which are tangents to the attack area circle, and extend them until they intersect with the perpendiculars to the downwind direction lines. (See (9) above). These lines will form a 30° angle either side of the downwind direction lines.

(12) Draw a line connecting the downwind corners of the 2 hazard areas (Points "X" and "Y" in Figure 9 - VI).

(13) Prepare and transmit a NBC 3 BIO to units and installations in the predicted hazard area in accordance with SOPs. (Figure 9 - VI).

g. Type "S", Case "1" and "2".



H_1 = radius of hazard area

(NR) **Figure 9-VII. Type "S", Case "1" and "2"**

(1) Obtain the location of the detection from the relevant NBC BIO message(s) (set FOXTROT or QUEBEC) and plot it on the map. (Figure 9 - VII).

(2) Draw a circle with the attack area radius, around the centre of the detection location. The area within this circle represents both the attack area and the hazard area.

(3) Prepare and transmit a NBC 3 BIO to units and installations in the predicted hazard area in accordance with SOPs. (Figure 9-VII)

0913. Hazard Areas for the First NBC CDR

1. When the wind direction does not change by 30 degrees or more, and does not drop below 10 KPH, the total downwind distance can be used to calculate a single hazard area as shown in Figure 9-VIII. The leading and trailing edges should also be computed, starting at the attack location. The leading and trailing edges should be displayed with lines drawn perpendicular to the downwind distance path, extending to the tangent lines.

2. When the wind direction changes by 30 degrees or more or the wind speed changes between Case "**1**" and Case "**2**", the recalculation procedures from para 1214 should be used for Type "**A**" chemical, as shown in Figure 9-IX.

a. Draw the attack area circle and initial hazard area for the NBC CDR time period containing the attack. For type **"S"** attack, draw the attack area radius circle centred on the observation location and wait for more information.

b. The hazard area at the end of that time period is drawn as a circle centred at the downwind edge (**d_1**) having a radius equal to the distance along the perpendicular line from the downwind direction line to one of the tangents.

c. If the next time period is Case "**1**" extend this circle by the distance **d_2**.

d. If the next time period is Case "**2**" draw a new downwind direction line for the new time period of distance **d_2** from the end of the **d_1** line. Repeat the triangle procedure from 912.b. with the circle just drawn being the new attack area.

e. Draw the circle containing the hazard area at the end of the second time period as for the end of the first time period.

f. Construct the hazard area for the third time period as described for the second time period. For Case "**2**", use the extended distance **DE** to include the leading edge.

g. The hazard area for the current NBC CDR includes the combined areas drawn for the initial hazard area and hazard areas associated with the second and third time periods, if applicable.

3. A NBC 3 BIO should be generated corresponding to the current NBC CDR time periods. The hazard area defined in set PAPAX should only include those points computed for the current NBC CDR which should be extended to 6 hours from the time of the attack. In this case, the hazard area for no more than 3 time periods of 2 hours will appear in PAPAX.

4. The leading and trailing edges are computed along the downwind distance path, starting at the attack location. The leading and trailing edges should be displayed with lines drawn perpendicular to the downwind distance path, extending to the tangent lines for the time period containing each distance.

5. For Type "**S**" attacks notice should be taken of the location of enemy positions further upwind of the hazard area, calculated in accordance with para 912.g. The area between the enemy positions and the template should be considered as being potentially BIO contaminated, with appropriate warnings issued and protective measures taken.

6. For Type "S" attacks, if a new detection is made outside of the hazard area, the procedures in 912.g. should be repeated for the new location.

0914. Hazards Beyond the First NBC CDR

1. Before proceeding to the next CDR, the downwind hazard area should be recalculated. The third time period for the recalculation is not to be extended to include the leading edge, e.g. distance **d_3** should be used in place of distance **DE**; however, the leading and trailing edge distances still need to be computed and plotted as points.

Distance **DA** is also not to be extended to result in 6 hours total time. Rather, $\mathbf{d_3}$ will end at the end of the current CDR (e.g., $2u_3$). If the attack occurs in the second or third CDR time period only two or one distance will result, as described in para 910.a. If actual measured meteorological conditions have been recorded during a current NBC CDR, a better estimate of the current hazard area will be obtained. (See para 906.e.).

2. An attack circle for the end of the current NBC CDR is drawn centred at the current downwind location and then extended to the tangent lines, as described in 913.b.(2). This attack circle defines the extent of the cloud at the end of the current NBC CDR. If this circle does not include both the leading and trailing edge distances, the circle radius should be enlarged around the current downwind location until both points are included.

3. The recalculation of Figure 9-VIII is shown in Figure 9-X with the new attack area adjusted to include the leading and trailing edges. The recalculation of Figure 9-IX is shown in Figure 9-XI with the new attack area. The attack area does not need to be enlarged to contain the leading and trailing edges for this case.

4. The hazard area for the next 6 hour time period should be computed when the next NBC CDR is received. The procedures in paras 911, 912, and 913 are used. If the next NBC CDR has not been received, the last time period for the current NBC CDR should be used for WHISKYM, XRAYM, and YANKEEM. When the next NBC CDR is received, the hazard prediction should be recalculated. The hazard area should then be reported in PAPAX of a new NBC 3 BIO.

5. Hazard areas should continue to be computed until no further contamination can be confirmed, or until the hazard duration that follows in para 915 has been reached. Attention should still be paid to the previously calculated areas, which may be contaminated until the end of agent effectiveness.

0915. Hazard Duration

1. Upon confirmation of a specific biological agent or toxin, the expected duration of viability of the agent should be recorded in the second field of set PAPAA. The attack area radius computed for the current NBC CDR should be entered into the first field of set PAPAA. This duration may be obtained from a data base on such agents. Agents may continue to be a hazard on the ground in the contaminated area from days to potentially years.

0916. Expected Arrival Times

1. The expected arrival time for a biological cloud can be computed by using the downwind distance path and the wind speed for each time period multiplied by 1.5. The latest time of arrival for a biological cloud can be computed by using the downwind distance path and the wind speed for each time period multiplied by 0.5. Arrival times are computed using these adjusted wind speeds and the downwind travel distances for each time period.

2. A line should be drawn perpendicular to the downwind distance path, which passes through the point of attack. For the time period containing the point of attack, the distance along the downwind path to the perpendicular line is divided by the adjusted wind speed. For previous time periods the downwind travel distance is divided by the adjusted wind speed. The expected arrival time or latest time of arrival is the sum of the contributing times, from the last time period back through the time period containing the attack. Some residual airborne cloud mass may remain behind the area contained between the leading and trailing edges.

3. Calculated arrival times are used for warning only. The actual arrival can only be determined by detection.

0917. Termination of Biological Hazard Assessment

1. For biological attack Types "**P**", "**Q**" and "**R**" where the NBC 3 BIO was generated from one or more NBC 1 BIO with chemical agent UNK, the NBC 3 BIO computations may be terminated if a chemical agent is confirmed. Otherwise, biological hazard assessment should continue until further information is available.

2. The final NBC report is the NBC 6 BIO; this report is a narrative description of biological attacks that have occurred in the reporting unit's area of operation. The NBC 6 BIO contains as much information as is known about the attacks. It is submitted only when requested.

0918. Generation and Processing of NBC 4 BIO

1. NBC 4 BIO is the recorded result of an initial detection, reconnaissance, survey, or monitoring action at a location being checked for the presence of biological agents. Each QUEBEC/ROMEO/SIERRA/TANGO/WHISKEY/YANKEE/ZULU segment in every NBC 4 BIO is a record of one contamination sample point's location, environment, time of reading, type and level of contamination, method of sampling, and local meteorological conditions. NBC 4 BIO will often be far downwind of the attack area location as defined in the corresponding NBC 2 and 3 BIO, since biological agents will most likely be detected as airborne contamination.

2. NBC 4 BIO can be assumed to be associated with the same attack if:
- They can be placed in the hazard area for a NBC 3 BIO between the expected earliest and latest times of arrival

or
- They are within 10 km and 2 hours of another NBC 4 BIO, which has already been assigned to an attack.

0919. Generation of NBC 5 BIO

1. NBC 4 BIO which have been assigned to the same attack may be used to produce a NBC 5 BIO which outlines the area of ground contamination within the downwind hazard region. Areas within which airborne biological contamination has

been detected may be reported in XRAYA as part of the NBC 3 BIO for the same attack.

0920. Examples

Example NBC CDR

AREAM/NDEL1//
ZULUM/231100ZNOV1999/231200ZNOV1999/231800ZNOV1999//
UNITM/-/DGT/KPH/C//
WHISKEYM/090/015/4/15/4/-/2//
XRAYM/090/015/3/17/5/-/1//
YANKEEM/090/015/4/18/5/-/1//

Example NBC 2 BIO

ALFA/US/A234/008/B//
DELTA/231300ZNOV1999/231305ZNOV1999//
FOXTROT/32UPG387764/AA//
GOLF/OBS/AIR/1/BML/20//
INDIA/SURF/BIO/NP/OTH//
TANGO/FLAT/SCRUB//
GENTEXT/NBCINFO/
MUNITIONS EXPLODED IN DUST LIKE CLOUDS, AND
INTELLIGENCE HAS INDICATED THAT A BIO ATTACK IS LIKELY//

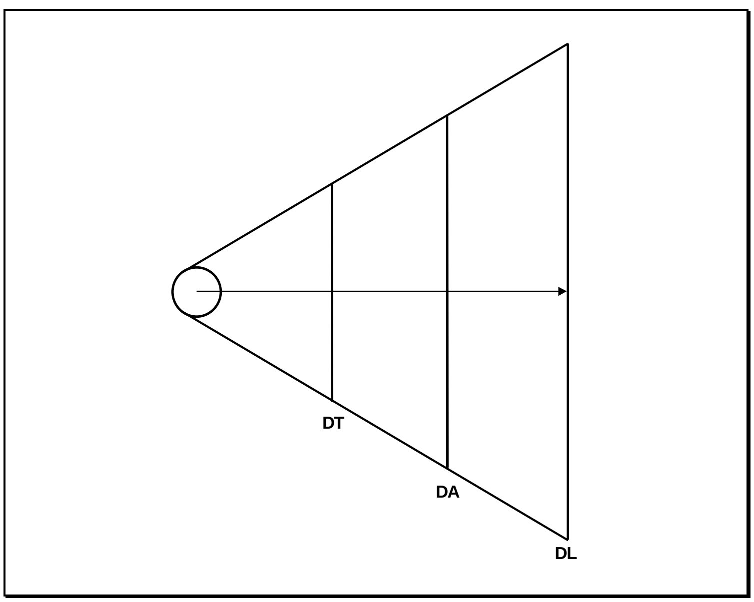


Figure 9-VIII.
Type Q, Case 2 Attack, 1 hour into NBC CDR, Constant 15 KPH Wind at Constant 90 DGT.

Example NBC CDR

AREAM/NDEL1//
ZULUM/231100ZNOV1999/231200ZNOV1999/231800ZNOV1999//
UNITM/-/DGT/KPH/C//
WHISKEYM/090/015/4/15/4/-/2//
XRAYM/135/015/3/17/5/-/1//
YANKEEM/180/015/4/18/5/-/1//

Example NBC 2 BIO

ALFA/US/A234/009/B//
DELTA/231300ZNOV1999/231305ZNOV1999//
FOXTROT/32UPG387764/AA//
GOLF/OBS/-/-/MSL/1//
INDIA/AIR/BIO/NP/OTH//
TANGO/HILL/BARE//
GENTEXT/NBCINFO/
MUNITION EXPLODED IN A DUST-LIKE CLOUD,
INTELLIGENCE INDICATES BIO ATTACK LIKELY//

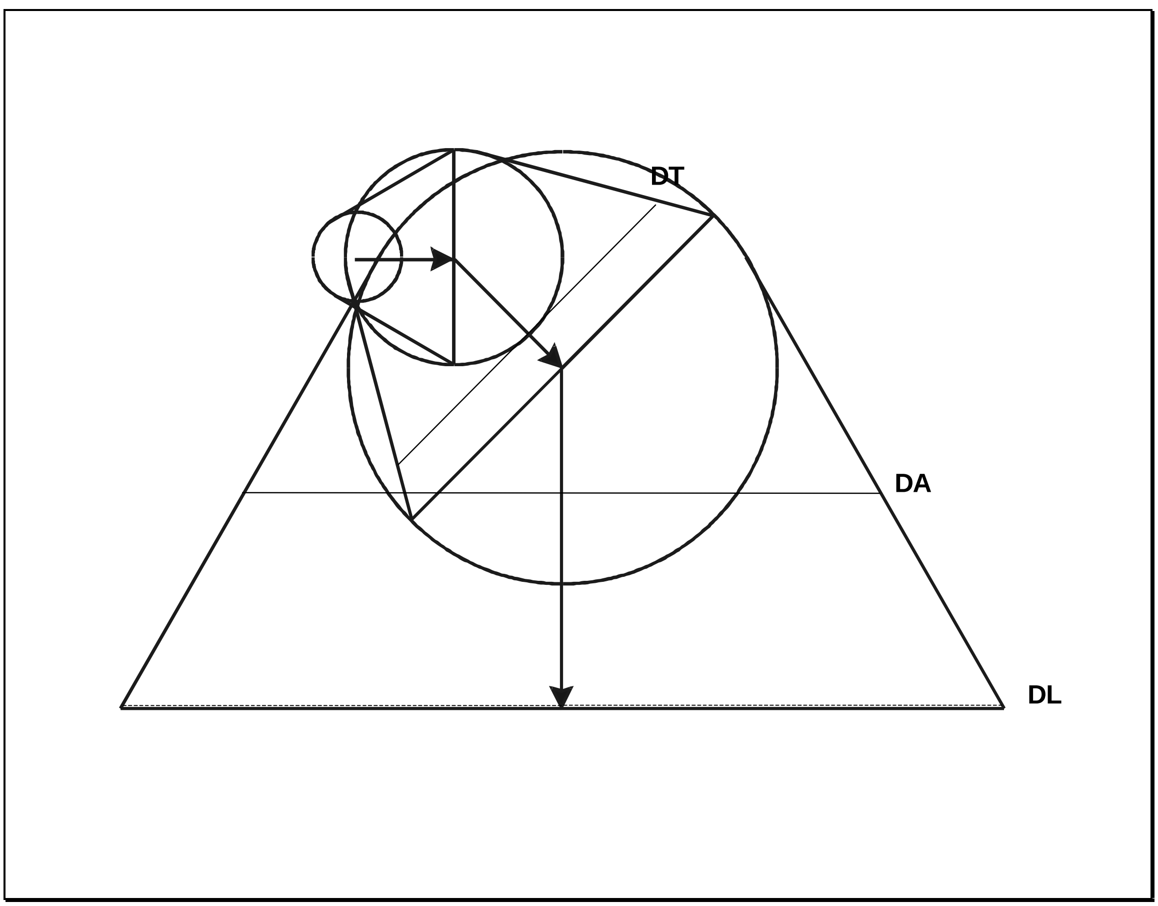


Figure 9-IX.

Type Q, Case 2 Attack, 1 hour into CDR, Changing Downwind Direction.
Example NBC CDR

AREAM/NDEL1//
ZULUM/231800ZNOV1999/231200ZNOV1999/231800ZNOV1999//
UNITM/-/DGT/KPH/C//
WHISKEYM/090/015/4/15/4/-/2//
XRAYM/090/015/3/17/5/-/1//
YANKEEM/090/015/4/18/5/-/1//

Example NBC 2 BIO

ALFA/US/A234/010/B//
DELTA/231300ZNOV1999/231310ZNOV1999//
FOXTROT/32UPG387764/AA//
GOLF/OBS/AIR/1/BML/20//
INDIA/SURF/BIO/NP/OTH//
TANGO/FLAT/SCRUB//
GENTEXT/NBCINFO/
MUNITIONS EXPLODED IN DUST LIKE CLOUDS,
INTELLIGENCE INDICATES BIO ATTACK LIKELY//

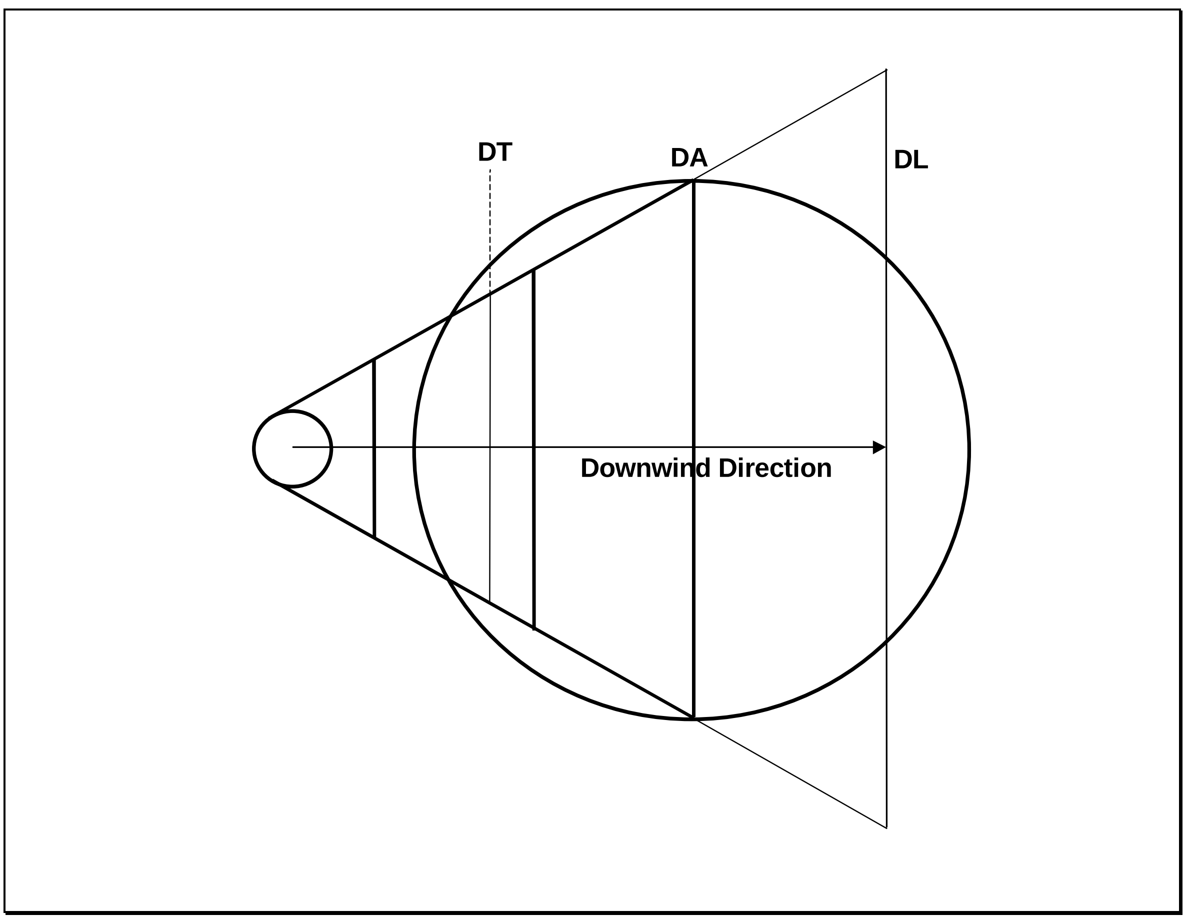


Figure 9-X. Type Q, Case 2 Attack.

Constant Wind Speed and Downwind Direction Using Measured Meteorology.

Example NBC CDR

AREAM/NDEL1//
ZULUM/231800ZNOV1999/231200ZNOV1999/231800ZNOV1999//
UNITM/-/DGT/KPH/C//
WHISKEYM/090/015/4/15/4/-/2//
XRAYM/135/015/3/17/5/-/1//
YANKEEM/180/015/4/18/5/-/1//

Example NBC 2 BIO

ALFA/US/A234/010/B//
DELTA/231300ZNOV1999/231305ZNOV1999//
FOXTROT/32UPG387764/AA//
GOLF/OBS/-/-/MSL/1//
INDIA/AIR/BIO/NP/OTH//
TANGO/HILL/BARE//
GENTEXT/NBCINFO/
MUNITIONS EXPLODED IN DUST LIKE CLOUDS,
INTELLIGENCE INDICATES BIO ATTACK LIKELY//

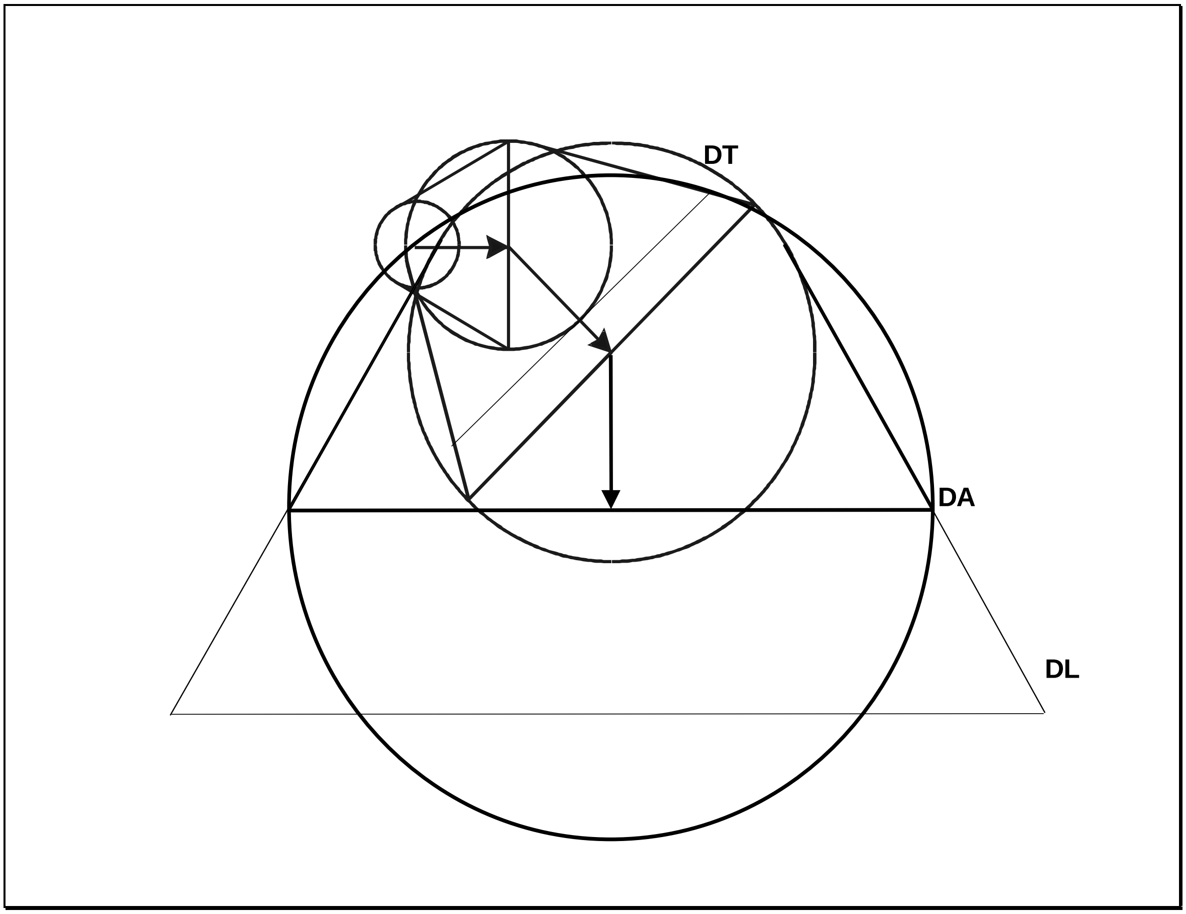


Figure 9-XI. Type Q, Case 2 Attack.
Changing Downwind Direction using Measured Meteorology.

CHAPTER 10

COMPUTATION OF EFFECTIVE DOWNWINDS, USING STANDARD PRESSURE LEVEL WINDS

1001. Introduction

1. There may occur cases where units, in particular naval ships, cannot obtain the meteorological information which is normally used for fallout prediction, i.e. the "NBC Basic Wind Message" (NBC BWM) and the "NBC Effective Downwind Message" (NBC EDM).

2. It may however be possible for the unit to obtain basic wind data, which are generally available from meteorological sources (airbases, MET-ships or mobile weather stations) and make use of these data for the computation of <u>effective downwind direction</u> and effective downwind speed.

3. This method of computation involves the use of "Standard Pressure Level Winds" as described below.

1002. Assumptions

1. The method assumes that the standard pressure level winds used are representative mean vector winds for contiguous layers of air, and that for any Standard Level (SL) the top of the layer is defined by the level:

$$\mathbf{SL_n + \frac{SL_{n+1} - SL_n}{2} = \frac{SL_n + SL_{n+1}}{2}}$$

and the bottom of the layer by the level:

$$\mathbf{SL_n - \frac{SL_n - SL_{n-1}}{2} = \frac{SL_n + SL_{n-1}}{2}}$$

1003. Method

1. The layers of the air, or parts thereof, are combined to form a total layer from the surface to the nuclear Cloud Bottom (CB) height for a particular weapon yield.

2. The layers allocated to each standard pressure level, and the nuclear cloud bottom parameters for the seven weapon yields, which are normally contained in an NBC EDM are given in the table on Figure 10-II.

3. The method involves the vector addition of the winds representing the layers up to and including the nuclear (CB) height, appropriately weighted to account for:

   a. The thickness of the layer associated with the standard pressure level, and

   b. the differing densities of the layers.

4. The weighting factors are given in Figure 10-III and Figure 10-IV, and are applied to the wind speeds given in units of knots, to obtain an effective downwind (EDW) speed in knots or in kilometres per hour (km/h) respectively.

5. In the absence of the 1000 hecto Pascal (hpa) wind data, the surface wind data should be used.

6. The reciprocal of the wind directions (adding or subtracting 180 degrees) contained in the meteorological wind data information must be used in the wind vector addition.

7. A wind vector plot must be constructed for each of the seven yield groups.

1004. Procedure

1. Obtain the meteorological data containing the direction and wind speed for each of the standard pressure levels.

2. Convert all wind directions to downwind directions by adding or subtracting 180 degrees.

3. Select the weapon yield or yields, for which the effective downwind direction and speed are to be computed.

4. By using the table on Figure 10-III or 10-IV, select the weighting factors which must be applied to the reported wind speed in knots for each standard pressure level related to the selected yield group.

5. The weighting factors in Figure 10-III are to be used to obtain the EDW speed in knots, and Figure 10-IV is used to obtain the EDW speed in km/h.

6. To prepare the wind vector plot, label ground zero (GZ). From GZ draw the 1000 hpa wind vector. The direction of the vector must be the corrected direction, and the length of the vector is the wind speed in knots multiplied by the weighting factor for the 1000 hpa standard pressure level and the selected yield. Any map scale may be used.

7. From the end of the 1000 hpa vector, draw the 850 hpa vector using the same procedure, and proceed by drawing all the vectors needed for the particular weapon yield group.

8. Draw a line from GZ to the end of the last vector.

9. Measure the angle between GN and the line from GZ to the CB height, clockwise. The measured number of degrees is the effective downwind direction for the selected weapon yield.

10. Measure the length of the line from GZ to CB. The length (the same map scale as used for the construction of the wind vector plot) gives the effective downwind speed for the selected weapon yield.

1005. Worked Example.

Given: MET information containing the following standard pressure level wind data:

Surface	**250°**	**08 knots**
850 hpa	**300°**	**10 "**
700 hpa	**300°**	**10 "**
500 hpa	**320°**	**15 "**
400 hpa	**290°**	**10 "**
300 hpa	**270°**	**15 "**
200 hpa	**280°**	**15 "**
150 hpa	**290°**	**20 "**
100 hpa	**320°**	**25 "**

Problem: Compute effective downwind data for weapon yield group DELTAM (31 KT - 100 KT). The effective downwind speed must be in knots.

1. Convert the wind directions given in the MET information, by adding or subtracting 180 degrees:

Surface	**070°**
850 hpa	**120°**
700 hpa	**120°**
500 hpa	**140°**
400 hpa	**110°**
300 hpa	**090°**

2. Calculate the wind vector lengths by multiplying the wind speed for each standard pressure level by the appropriate weighting factor.
As the wind speed is wanted in units of knots, the weighting factors for each standard pressure level are to be found from Figure 10-III. Use the horizontal column for weapon yield group DELTAM:

1000 hpa (or surface)	**0.12 * 08 knots**	**=**	**0.96 knots**
850 hpa	**0.22 * 10 "**	**=**	**2.2 "**
700 hpa	**0.26 * 10 "**	**=**	**2.6 "**
500 hpa	**0.20 * 15 "**	**=**	**3.0 "**

400 hpa	**0.13 * 10**	**"**	**=**	**1.3**	**"**
300 hpa	**0.07 * 15**	**"**	**=**	**1.05**	**"**

3. Construct the wind vector plot. In this example the map scale 1 NM = 2 cm is used (Figure 10-I).

a. Label GZ and the GN line.

b. From GZ draw the first vector in direction 070 degrees, the length being 1.92 cm.

c. From the end of the first vector, draw the second in direction 120 degrees and 4.4 cm long. Proceed in this manner, thus completing the wind vector plot for the DELTAM weapon yield group.

4. Draw the line from GZ to the end of the 300 hpa vector, and measure the direction of this line to be 117° and the length of the line to be 21.2 cm, equal to 10.6 knots.

Solution:
For the DELTAM weapon yield group the <u>effective downwind direction</u> is 117°, and the effective downwind speed is 10.6 knots.

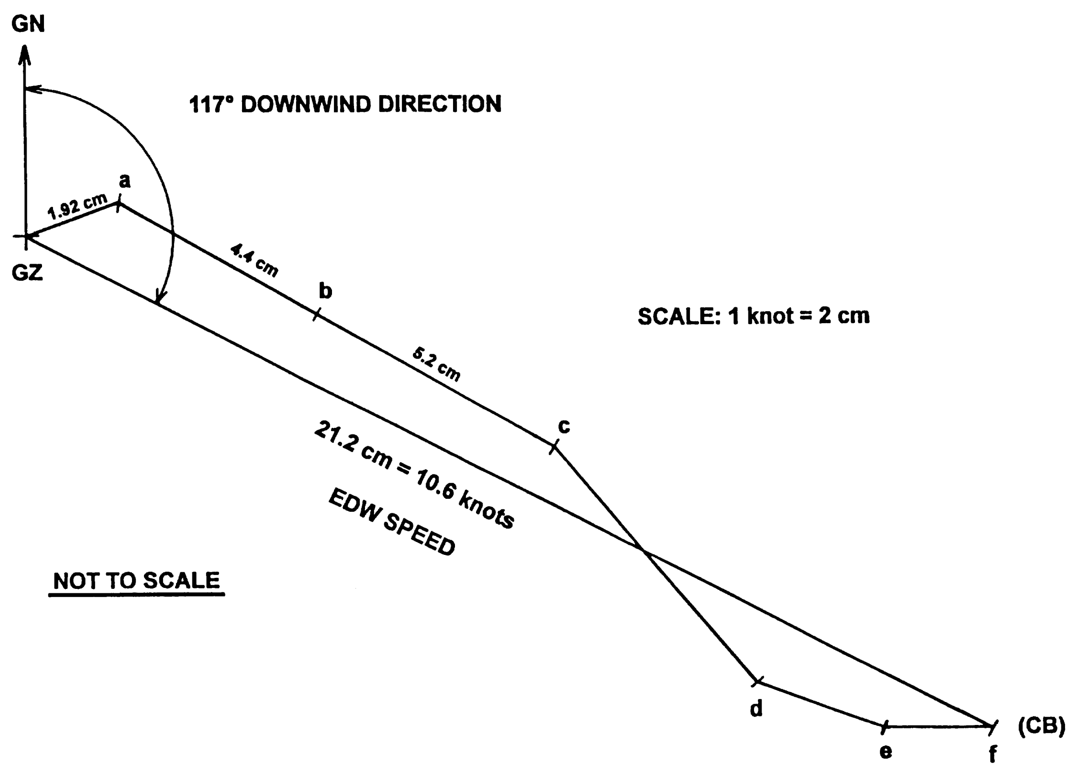


Figure 10-1, DELTAM Yield Group Wind Vector Plot.

Standard Level		Allocated Layer 10^3 Feet	Nuclear Cloud Base 110^3 Feet	Weapon	
Pressure hpa	Height 10^3 Feet			Yield KT	Group
1000	00,3	00,0 - 02,5			
850	04,8	02,5 - 07,4			
700	09,9	07,4 - 14,1	08,5	2	A
			14,1	5	B
500	18,3	14,1 - 21,0			
400	23,6	21,0 - 26,8	24,9	30	C
300	30,1	26,8 - 32,1	30,5	100	D
250	34,0	32,1 - 36,4	36,1	300	E
200	38,8	36,4 - 41,8			
150	44,7	41,8 - 48,9	44,3	1 MT	F
100	53,2	48,9 - 56,9	51,8	3 MT	G

Figure 10-II,
Layers allocated to Standard Pressure Levels,
Cloud Base (Bottom) Parameters for the seven Yield Groups.

Yield Group	Nuclear Cloud Bottom 10^3 Feet	Standard Pressure Levels (hpa)									
		1000	850	700	500	400	300	250	200	150	100
A	08,5	0,33	0,56	0,11							
B	14,1	0,21	0,36	0,43							
C	24,9	0,14	0,24	0,29	0,22	0,11					
D	30,5	0,12	0,22	0,26	0,20	0,13	0,07				
E	36,1	0,11	0,20	0,23	0,18	0,13	0,09	0,06			
F	44,3	0,10	0,18	0,21	0,17	0,11	0,09	0,06	0,06	0,02	
G	51,8	0,10	0,17	0,20	0,16	0,10	0,08	0,06	0,06	0,05	0,02

Figure 10-III,
Weighting Factors applied to Wind Speeds in Knots to obtain the EDW Speed in Knots.

Yield Group	Nuclear Cloud Base km	Standard Pressure Levels (hpa)									
		1000	850	700	500	400	300	250	200	150	100
A	2,6	0,61	1,04	0,20							
B	4,3	0,39	0,67	0,79							
C	7,6	0,26	0,45	0,53	0,41	0,20					
D	9,3	0,23	0,40	0,47	0,37	0,25	0,13				
E	11,0	0,21	0,36	0,43	0,33	0,24	0,17	0,11			
F	13,5	0,19	0,33	0,39	0,31	0,21	0,16	0,11	0,11	0,04	
G	15,8	0,18	0,32	0,37	0,29	0,20	0,15	0,11	0,10	0,10	0,03

Figure 10-IV,
Weighting Factors applied to Wind Speeds in Knots to obtain EDW Speed in km/h.

CHAPTER 11

CONTAMINATION PREDICTION SYSTEM FOR MERCHANT SHIPS AT SEA AND THE MERWARN SYSTEM

SECTION I - GENERAL

1101. Significance of NBC Warnings

1. Radioactive fallout from nuclear explosions and chemical and biological contamination (hereafter collectively referred to as contamination) on sea and land targets, particularly from the latter, may affect large areas of adjacent waters.

2. The areas affected will depend upon the prevailing wind conditions, and any ship close to or approaching these areas will be in grave danger. It is therefore essential that shipping should be warned of the fallout hazards and contamination in order that:

   a. Passive defence measures, such as switching on washdown systems, may be taken.

   b. Course may be altered, if necessary, to avoid the dangerous zones.

1102. The MERWARN System, Warnings to Merchant Ships at Sea

1. A simplified contamination warning system has been established throughout NATO for broadcasting, via MERCOMMS and coastal radio stations, warnings of contamination dangerous to merchant shipping. This system calls for the origination, by NATO naval authorities, of five types of messages:

   a. MERWARN NBC Effective Downwind Message (MERWARN NBC EDM). The MERWARN NBC EDM is a prediction, for a specified sea area and time interval, of the fallout, which will result from a one megaton (1 MT) nuclear surface explosion. It will give the master of a ship, observing a nuclear explosion, an immediate indication of the area likely to be affected by fallout.

   b. MERWARN NBC 3 NUC.
   The MERWARN NBC 3 NUC will be issued after a nuclear attack and gives fallout data for a specific nuclear explosion or series of explosions, which will be identified in the message.

c. MERWARN NBC Chemical Downwind Message, (MERWARN NBC CDM).
This contains a forecast of the meteorological data needed for the chemical hazard area prediction procedure.

d. MERWARN NBC 3 CHEM.
This message is issued to pass immediate warning of a predicted chemical contamination and hazard area.

e. MERWARN DIVERSION ORDER.
This is a general diversion order, based upon the fallout threat, whereby merchant ships proceeding independently are passed evasive routing instructions of a general nature.

2. In some cases it may be better to provide warning of contamination by means of general plain language messages rather than by the formats above.

3. The messages in a., b. and c. above are explained in more detail in Section II of this Chapter.

4. Biological procedures for shipping are the same as for land and are described in Chapter 9.

1103. MERWARN Originating and Diversion Authorities

1. MERWARN Originating and Diversion authorities will be designated by national or NATO commanders before commencement of operations.

1104. Precedence of NBC Messages

1. All MERWARN NBC messages should be given the precedence FLASH (Z) to ensure rapid handling on any military circuit between the originating authority and the MERCOMMS and/or coastal radio stations. This precedence should not be used where the rules for the use of the International Safety Signal (TTT for CW and Security for voice circuits) apply. (See para 1105).

1105. Method of Promulgation

1. All MERWARN NBC EDM, MERWARN NBC CDM, MERWARN NBC 3 CHEM and NBC 3 NUC messages will be transmitted in plain language, using GMT, preceded by the International Safety Signal (TTT for CW and Security for voice circuits) from the appropriate MERCOMMS station and from all the coastal radio stations of the area concerned. Thus masters need not concern themselves with the identity of the MERWARN originators, but only with the sea areas covered by each message.

1106. Relay Responsibilities

1. Originating authorities are responsible for relaying to:

a. The appropriate Coast Earth Station (INMARSAT) (CES), Coast Radio Station (CRS) under their control and/or other CRS in their geographic area.

b. Their own national authorities (for transmission to merchant ships not yet copying MERCOMMS).

c. Adjacent MERWARN originators and shipping diverting authorities within the geographical area affected by each MERWARN NBC 3 NUC message.

Note: Adjacent MERWARN originators are responsible for relaying to CES/CRS under their control as necessary.

1107. Danger Zones

1. All shipping in waters out to 200 nautical miles from any coast at the outset of war must be regarded as being in an area of possible fallout danger from nuclear attacks on shore.

SECTION II - MERWARN NBC MESSAGES

1108. MERWARN NBC EDM

1. MERWARN NBC EDM is a prediction, for a specified sea area and time interval, of the fallout, which will result from a one megaton (1 MT) nuclear surface explosion. It will give the master of a ship, observing a nuclear explosion, an immediate indication of the area likely to be affected by fallout.

2. MERWARN NBC EDM will be issued at 12 hour intervals from the time of activation of the MERCOMMS system, and will be valid 12 hours ahead from the date and time given in the first line of the message (A). In the event of changing meteorological conditions it may be necessary for the originating authorities to issue MERWARN NBC EDM more frequently. The original MERWARN NBC EDM will automatically be overruled by the latest MERWARN EDM issued.

a. The following standard format will be used:

A. Message identifier (MERWARN NBC EDM) and date-time-group (GMT) from which valid for 12 hours ahead.
B. Specified sea area for which valid.
C. Effective downwind direction (degrees, 3 digits) and effective downwind speed (knots, 3 digits).
D. Downwind distance of Zone I (nautical miles, 3 digits).
E. Additional information.

b. Example:

A. MERWARN NBC EDM 180600ZSEP1999
B. Baltic Sea west of 15° 00'E
C. 045 - 020
D. 078
E. NIL.

Note: Sets B., C. and D. may be repeated for different sea areas should this be considered necessary.

1109. MERWARN NBC 3 NUC, Standard Format

1. MERWARN NBC 3 NUC will be issued after a nuclear attack producing fallout, and gives fallout data for a specific explosion or series of explosions, which will be identified in the message.

2. MERWARN NBC 3 NUC messages are issued as soon as possible after the attack, and at six hour intervals (to the nearest hour) thereafter, for as long as the fallout danger exists. They contain information, which enables the master of a ship to plot the danger area.

3. The standard format of MERWARN NBC 3 NUC contains the sets ALFA, DELTA, FOXTROT and PAPAB of the military NBC 3 NUC message (see Chapter 2).

a. The MERWARN NBC 3 NUC has the following structure:

MERWARN NBC 3 NUC

ALFA: **Strike Serial Number (as defined by the naval authority)**
DELTA: **Date-time Group of detonation (GMT)**
FOXTROT: **Location of attack (latitude and longitude, or geographical place name) and qualifier (2 digits as to refer in Annex C, para C.17).**
PAPAB: **Effective wind speed (3 digits and unit of measurement), downwind distance of Zone I (3 digits and unit of measurement),**
cloud radius (2 digits and unit of measurement),
left and right radial line of the predicted fallout hazard area (3 digits and unit of measurement each)

b. Example:

MERWARN NBC 3 NUC

ALFA/UK/NBCC/02-001/N//
DELTA/021405ZSEP1999//
FOXTROT/451230N014312E/AA//
PAPAB/012KTS/028NM/02NM/272DGT/312DGT//

1110. MERWARN NBC 3 NUC, Plain Language Format

1. The MERWARN NBC 3 NUC standard format (see para 1109) may not be suitable after a multiple nuclear attack which produces fallout from several bursts in a large or complex target area. In such cases warnings will be plain language statements of a more general nature, indicating area affected and expected movement of the fallout.

a. Example 1:

MERWARN NBC 3 NUC

ALFA/UK/02-001/N//
DELTA/021405ZSEP1999//
Fallout extends from Glasgow area to eastern Ireland at 021405Z and is spreading westwards with 12 Knots. Irish Sea is likely to be affected within an area of 60 nautical miles of the British coast.

b. Example 2:

MERWARN NBC 3 NUC

ALFA/IT/15-001/N//
DELTA/150630ZFEB1999//
Fallout is estimated to be occurring at 150830Z over Adriatic Sea east of the coast line Bari/Brindisi up to a distance of 30 nautical miles. Fallout is moving south-eastwards with 016 Knots, getting weaker. It is not expected to be dangerous after 151000Z.

1111. MERWARN NBC CDM

1. The MERWARN NBC CDM message contains information needed for CHEM/BIO hazard prediction by the master of a merchant ship. The MERWARN NBC CDM will be issued as required via the MERCOMMS and will be valid as specified. In the event of changes in the meteorological conditions, the MERWARN NBC CDM will be updated as required.

a. The following standard format will be used:

ALFA:	**Message identifier (MERWARN NBC CDM), date/time group (GMT) from which valid 6 hours ahead.**
BRAVO:	**Specified sea area for which valid.**
CHARLIE:	**Downwind direction (degrees, 3 digits) and downwind speed (knots, 3 digits).**
DELTA:	**Maximum downwind hazard distance (nautical miles, 3 digits).**
ECHO:	**Additional information.**

b. Example:

ALFA MERWARN NBC CDM 180600ZSEP1999//
BRAVO BALTIC SEA WEST OF 15°00'E//
CHARLIE 045/020//
DELTA 010//
ECHONIL//

1112. MERWARN NBC 3 CHEM

1. MERWARN NBC 3 CHEM. This message is issued to pass immediate warning of a predicted chemical contamination and hazard area. MERWARN NBC 3 CHEM reports are issued as soon as possible after each attack. They contain sufficient information to enable the master of a ship to plot the downwind hazard area.

a. The following standard format will be used for MERWARN NBC 3 CHEM:

MERWARN NBC 3 CHEM (Message identifier)

ALFA:	**Strike serial number (as defined by naval authority).**
DELTA:	**Date/time group (Z) of start and end of attack.**
FOXTROT:	**Location of event.**
GOLF:	**Delivery Means.**
INDIA:	**Release Information.**
PAPAA:	**Predicted attack and hazard area.**

Note: If downwind speed is 5 knots or less, or variable, this letter item will consist of three (3) digits instead of coordinates, representing the radius of a circle in nautical miles centred on the location of the attack contained in set FOXTROT.

YANKEE: **The downwind direction and speed.**
ZULU: **Information on actual weather conditions.**
GENTEXT: **Remarks**

Note: Some of the letter items above may not be completed in the report that is received, but there will be sufficient information for a Downwind Hazard plot to be carried out.

b. The MERWARN NBC 3 CHEM standard format may not be suitable after a multiple chemical attack, which produces a hazard from several attacks or depositions in a large or complex target area. In such cases warnings will be plain language statements of a more general nature, indicating areas affected and expected movement of the hazard.

Example 1:

MERWARN NBC 3 CHEM

ALFA/DA/NBCCC-4/003/C//
DELTA/020300ZSEP1999//
GENTEXT/ PERSISTENT NERVE AGENT VAPOUR HAZARD EXISTS FROM NORFOLK TO HATTERAS AT 020300Z SEP 1999 AND IS SPREADING SOUTH-EASTWARDS AT 017 KNOTS. SEA AREA OUT TO 100 NAUTICAL MILES FROM COAST LIKELY TO BE AFFECTED BY 020600ZSEP1999//

Example 2:

MERWARN NBC 3 CHEM

ALFA/DA/NBCC-3/003/C//
DELTA/020300ZSEP1999//
GENTEXT/ PERSISTENT NERVE AGENT VAPOUR HAZARD AT 020600 SEP 99 IS ESTIMATED TO BE OCCURRING OVER MOST OF THE SEA AREAS OUT TO 40 MILES EAST OF THE COAST LINE FROM NORFOLK TO HATTERAS. HAZARD IS EXPECTED TO HAVE DISPERSED BY 021000Z SEP1999//

1113. MERWARN DIVERSION ORDER

1. In addition to the origination of MERWARN NBC EDM and MERWARN NBC 3 NUC messages, naval authorities may, if circumstances dictate, broadcast general diversion orders, based upon the fallout threat, whereby merchant ships proceeding independently will be passed evasive routing instructions of a more general nature, using the standard Naval Control of Shipping (NCS) identifier MERWARN DIVERSION ORDER.

a. MERWARN DIVERSION ORDER

b. English Channel closed. All shipping in North Sea remain north of 052 degrees N until 031500ZSEP1999.

1114. Other Warnings

1. ATP-2, VOL II, gives instructions for the display of signals by ships, which have received a MERWARN NBC 3 NUC message, which affects their area. Ships arriving from sea but remaining beyond visual/aural range of shore stations should continue to keep radio watch in order to receive MERWARN Messages.

SECTION III - MERWARN PLOTTING

1115. Ground Zero.

1. The point at the surface on sea or land immediately below or above a nuclear explosion is called Ground Zero (GZ).

1116. Effective Downwind Direction and Downwind Speed

1. Winds in the atmosphere vary considerably with height, both in direction and speed, and have a major influence on the distribution of radioactive fallout from a nuclear cloud.

2. The worst contamination will fall to the surface along a path represented by the average wind between the surface and the middle of the nuclear cloud.

3. Based upon meteorological information on the wind conditions in the air space between the surface and the height of the nuclear cloud, NBC Collection Centres will compute the average direction and speed of the radioactive particles' path from the nuclear cloud to the surface.

4. The results of this computation make the fallout prediction, expressed in the terms of effective downwind direction and wind speed. It should be noted that the direction of the effective downwind is the direction towards which the wind blows. This direction is also known as the fallout axis.

5. The surface wind will usually be considerably different from the effective downwind, both in direction and speed, and the surface wind should never be used to estimate the drift of fallout.

1117. The Fallout Pattern Criteria

1. The predicted fallout area consists of two zones, Zone I and II, the criteria of which are:

a. Zone I is the zone of immediate concern. Within this zone there will be areas where exposed, unprotected personnel may receive doses of 150 cGy or greater, within 4 hours. Casualties among personnel may occur within portions of this zone. However, radiation risk category for emergency risk is changing from 150 cGy to 125 cGy.

b. Zone II is the zone of secondary hazard. Within this zone the total dose received by exposed, unprotected personnel is not expected to reach 150 cGy within a period of 4 hours after the actual arrival of fallout, not even when the radioactive fallout remains on the deck of the ship. However, radiation risk category for emergency risk is changing from 150 cGy to 125 cGy.

c. Outside the two zones the risk will be negligible. However, radiation risk category for negligible risk is changing from 50 cGy to 75 cGy.

1118. Ship's Fallout Template.

1. To simplify the plotting and presentation of fallout information in ships, while preserving a reasonable accuracy, a "Fallout Template" is required.

2. A "Ship's Fallout Template" is shown in Figure 11-I, designed for use in naval ships as well as in merchant ships.

3. The table containing cloud radii and safety distances at the bottom of the template is for use in naval ships only, and should not be used by merchant ships.

4. For the purpose of further simplification, merchant ships are to use cloud radii and safety distance as follows:

a. Plotting from MERWARN NBC EDM: Use cloud radius 10 nautical miles and safety distance 15 nautical miles in all cases.

b. Plotting from MERWARN NBC 3 NUC: Use the cloud radius given in the MERWARN NBC 3 NUC and, in all cases, a safety distance of 15 nautical miles.

1119. Fallout Plotting in Merchant Ships

1. When a nuclear explosion is reported in a MERWARN NBC 3 NUC message, the master of a merchant ship should immediately plot the fallout area, using the information contained in the message.

2. When a MERWARN NBC 3 NUC is not available, e.g. when a nuclear detonation is observed from the ship, the data contained in the current MERWARN NBC EDM should be used. The plotting procedures are almost identical in the two cases.

3. The transparent Ship's Fallout Template is used, and the plotting should be made in the following order:

a. Look up fourth and fifth field of set PAPAB (left and right radial line of the fallout area) and calculate the bisector. This line is the equivalent to the downwind direction. Draw the grid north (GN) line from the centre of the inverted compass rose (GZ) through the number of degrees on the compass rose equal to the above calculated downwind direction.

b. Using the scale of the chart on which the plot is to be used and with GZ as centre and the downwind distance of Zone I (set PAPAB, field two) as radius, draw an arc between the two radial lines printed on the template on each side of the downwind axis.
Using double the distance of Zone I as radius, draw another arc, representing the Zone II downwind distance.

c. Using the chart scale, with GZ as centre draw a semicircle upwind of GZ, the radius of the circle being the radius given in the MERWARN NBC 3 NUC, (set PAPAB, field three). The preprinted semi circles may be helpful.

d. From the intersections of the Zone I arc with the two radial lines, draw lines to the ends of the cloud radius semi circle.

e. Determine the area in which fallout deposition is predicted to occur at any given time after the detonation:

(1) Multiply the effective downwind speed (from MERWARN NBC 3 NUC, set PAPAB, first field) by the time after burst (in hours), the result being a distance in nautical miles.

(2) To and from this distance add and subtract a safety distance of 15 nautical miles (see para 1119.b.) to allow for finite cloud size, diffusion and wind fluctuations. The result is two distances.

(3) With GZ as centre and the two distances obtained in (2) as radii, draw arcs across the plotted fallout area.

(4) The area enclosed between the two arcs will contain, in most cases, the area of deposition of fallout at this particular time after the burst. (See the worked example in para 1120).

1120. Plotting from MERWARN NBC 3 NUC, Example.

1. Given:

MERWARN NBC 3 NUC

ALFA/UK/NBCC/09-001/N//
DELTA/091715ZSEP1999//
FOXTROT/PLYMOUTH/AA//
PAPAB/018KTS/040NM/05NM/275DGT/315DGT//

2. Problem:
Determine the predicted fallout area and the area within which fallout is predicted to deposit at the surface at 091845ZSEP1999.

3. Solution:
See Figure 11-II.

a. Calculate the downwind direction 295 degrees as bisector from left and right radial line from set PAPAB, fourth and fifth field. Draw the GN line from GZ through 295 degrees of the inverted compass rose on the template.

b. From set PAPAB, the downwind distance of Zone I is 040 nautical miles. Therefore the Zone II downwind distance is 2 x 40 = 80 nautical miles. Using the appropriate chart scale, with GZ as centre and 40 and 80 nautical miles as radii, draw arcs between the two radial lines.

c. From set PAPAB, third field, the cloud radius is 05 nautical miles. With GZ as centre and 5 nautical miles as radius draw the cloud radius semicircle upwind of GZ. The preprinted semi circles may be helpful.

d. Connect the ends of the cloud radius semi circles with the intersection of the left and right radial lines and the Zone I arc.

e. 091845Z is 1½ hours after the burst. From set PAPAB, first field, obtain the speed of the effective downwind, i.e. 018 knots.
018 knots * 1½ h = 27 nautical miles.
The safety distance is always 15 nautical miles.
27 + 15 = 42 nautical miles, and
27 - 15 = 12 nautical miles.

f. With GZ as centre and 42 and 12 nautical miles as radii draw arcs across the fallout pattern. The area enclosed by the two arcs and the contour of the pattern is the area within which fallout is predicted to deposit at the surface at 091845ZSEP 1999.

1121. Contamination Plotting in Merchant Ships

1. When a chemical attack is reported in a MERWARN NBC 3 CHEM message, the following procedure should be followed:

   a. Plot the location of the attack from the details in set FOXTROT.

   b. Plot the coordinates or radius of the circle contained in set PAPAA.

1122. Observations without MERWARN NBC 3 CHEM

1. If a MERWARN NBC 3 CHEM is not received but either observations of an attack, or a local report of an attack is received, then the following procedure should be carried out:

   a. Mark the actual or suspected location of the attack on the chart.

   b. Draw a circle, radius 0.5 NM, centred on the attack location. From the centre of the attack area draw the downwind direction which is contained in set CHARLIE of the MERWARN NBC CDM.

   c. Place the centre of the ship's chemical template on the centre of the attack area. Position the centre line of the template on the downwind direction line.

   d. Keeping the centre line of the template on the downwind direction, move the template upwind until the 20° lines of the template make tangents with the circle around the attack area.

   e. Mark the tangent lines using the holes in the template. Join these marks with the attack area circle.

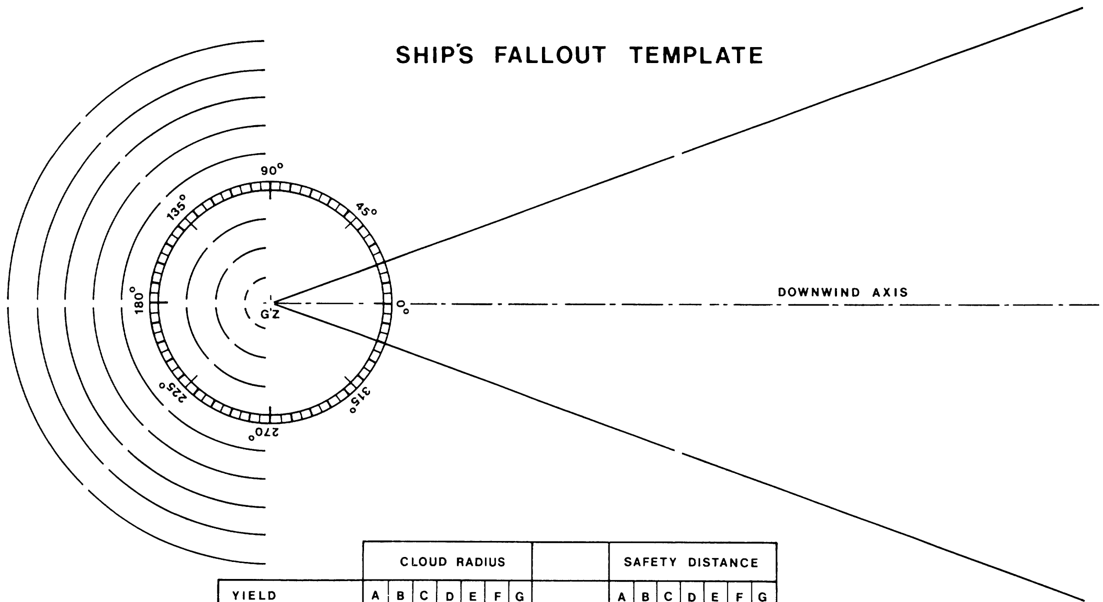
   f. If the chemical agent is identified as nerve agent, take the downwind hazard distance for the miosis level from Annex E for the agent. Measure this distance from the centre of the attack area on the downwind direction line and mark it. Through this point draw a line perpendicular to the downwind direction line until it meets the 2 tangents.

   g. If the agent is unknown then use the downwind hazard distance of 44 NM as this will be the worst case.

   h. The hazard area is now defined as the area bounded by:

      (1) The upwind radius of the attack area.
      (2) The 20° tangents.
      (3) The downwind hazard distance line.

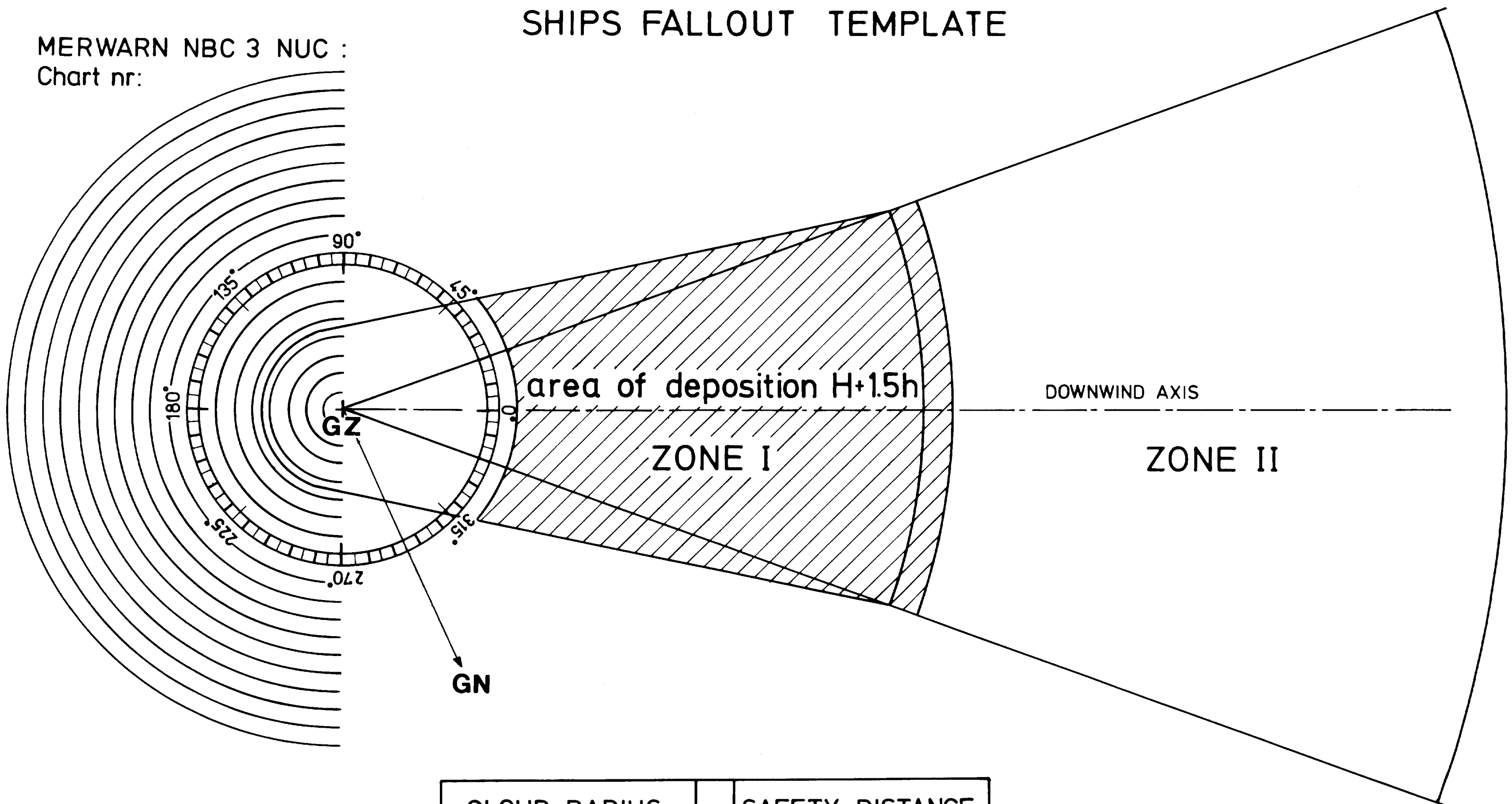
i. Adjustments to the downwind hazard distance can be made as and when the agent is identified.



	CLOUD RADIUS								SAFETY DISTANCE						
YIELD	A	B	C	D	E	F	G		A	B	C	D	E	F	G
NAUTICAL MILES	0.7	1.0	2.3	3.7	6.1	9.7	15		1.3	1.5	3.4	5	7	13	19
KILOMETERS	1.2	1.9	4.2	6.8	11.2	18	28		2.5	3.0	6.7	10	14	25	36

Figure 11-I, Ship's Fallout Template.

SHIPS FALLOUT TEMPLATE



	CLOUD RADIUS								SAFETY DISTANCE						
YIELD	A	B	C	D	E	F	G		A	B	C	D	E	F	G
NAUTICAL MILES	.7	1.0	2.3	3.7	6.1	9.7	15		1.3	1.5	3.4	5	7	13	19
KILOMETERS	1.2	1.9	4.2	6.8	11.2	18	28		2.5	3.0	6.7	10	14	25	36

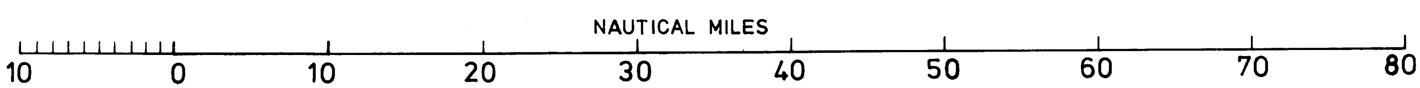


Figure 11-II, Fallout Plotting, using Ship's Template.

CHAPTER 12

DETERMINATION OF THE LIKELY HAZARD AREA FOLLOWING A CHEMICAL ATTACK, AND THE WARNING OF UNITS WITHIN THE AREA (LAND)

SECTION I - GENERAL INFORMATION

1201. Aim

1. The chemical prediction procedure for land provides information on the location and the extent of the hazard area and the duration of the hazard resulting from attacks with chemical weapons.

2. It provides the necessary information for commanders to warn units within the predicted hazard area.

1202. Definitions

a. ATTACK AREA. This is the predicted area immediately affected by the delivered chemical agent on land.

b. HAZARD AREA. This is the predicted area in which unprotected personnel may be affected by vapour spreading downwind from the ATTACK AREA. The downwind distance depends on the type of attack, the weather and terrain in the attack area and the area downwind of the ATTACK AREA.

c. CONTAMINATED AREA. This is the area in which liquid hazard may remain some time after the attack. The actual shape and duration can only be determined by surveys.

Note: If actual surveys alter the initial data used for determination of the attack the NBC 2 CHEM and/or the NBC 3 CHEM must be changed or updated.

1203. General

1. The prediction of the attack and hazard area is dependent upon:

a. the means of delivery,

b. the type of chemical attack, and

c. the meteorological factors.

1204. Means of Delivery

1. The means of delivery and the type of agent container are listed in Annex C, C04.a. and C04.b.

1205. Types of Chemical Attacks

1. Chemical attacks can be divided into 3 types:

a. Air Contaminating Attacks (Type A) (non persistent agents), and

b. Ground Contaminating Attacks (Type B) (persistent agents).

c. Dection after unobserved attack (type C)

2. A type A attack is to be assumed unless liquid is present which is subsequently confirmed to be a persistent agent.

Note: For Blood Agents, the attack area is a circle of 1 km radius with no hazard area.
Alternatively, plot on the map the attack information in accordance with national directives.

1206. Procedures and Constraints

1 **Procedures.**

a. Record and update the following information:

(1) Weather information from relevant NBC CDMs, and/or

(2) equivalent weather information from local measurements/ observations.

b. Record terrain features and wooded areas etc. which may influence the direction and speed of chemical agent clouds.

c. A NBC 3 CHEM may be generated and considered for distribution whenever a chemical attack has taken place. If chemical detection equipment is available this report may be generated from one or more NBC 1, 2 or 4 CHEM.

d. On receipt of NBC 1 CHEM or NBC 2 CHEM, as rapidly as possible, estimate the meteorological parameters for the attack area and downwind of the attack area.

e. Select, in accordance with national directives, the weather information to be used and calculate the predicted downwind hazard area.

f. On receipt of an NBC 4 CHEM plot a circle of 10km based on the location specified in QUEBEC. This applies to a detection after an unobserved attack

2. **Constraints**

a. When calculating the predicted downwind hazard area from chemical attacks, many factors will affect the accuracy of the prediction. Some of these factors are:

(1) Type of and amount of chemical agents.
(2) Type of and amount of agent containers.
(3) Terrain composition.
(4) Weather (rain, clouds etc.).
(5) Air stability.
(6) Type of surface(s).
(7) Vegetation(s).
(8) Surface air temperature.
(9) Relative Humidity,

and changes to these factors.

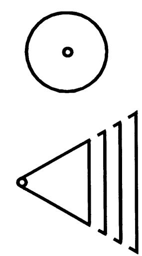
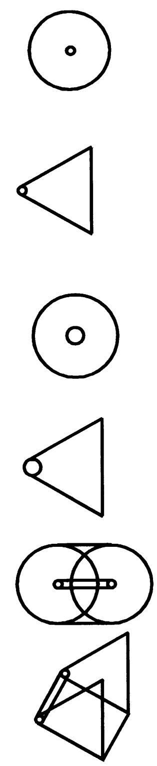
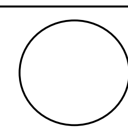
b. Some of these factors are not considered when using the procedures in this chapter, unless evaluated and estimated manually by the user.

c. The procedure shown in this chapter is based on the limited amount of information available at the time of attack.

d. To be able to make more accurate predictions, more information about the listed factors has to be available and more sophisticated methods have to be used for prediction. Such procedures are described in AEP-45.

1207. Types and Cases of Chemical Attacks

1. Chemical attacks are divided into three types “A” air contaminating attacks, “B” ground contaminating attacks and “C” where the attack origin is unknown. These are further subdivided into cases based on radius of attack area and the wind speed. These are outlined in the table below. Procedures for determining the downwind hazard are detailed in Section II.

TYPE OF AGENT CONTAINER	RADIUS OF ATTACK AREA	WIND SPEED	TYPE	CASE	FIGURE
BML, BOM, RKT, SHL, MNE, UNK, surface burst MSL	= 1 km	≤ 10 KPH	A	1	
BML, BOM, RKT, SHL, MNE, UNK, surface burst MSL	= 1 km	> 10 KPH		2	
BML, SHL, MNE, surface burst RKT and MSL	= 1 km	≤ 10 KPH	B	1	
BML, SHL, MNE, surface burst RKT and MSL	= 1 km	> 10 KPH		2	
BOM, UNK, air burst RKT and MSL	= 2 km	≤ 10 KPH		3	
BOM, UNK, air burst RKT and MSL	= 2 km	> 10 KPH		4	
SPR, GEN	= 1 km	≤ 10 KPH		5	
SPR, GEN	= 1 km	> 10 KPH		6	
Detection after unobserved attack (NBC 4 CHEM message)	= 10 km		**C**		

Note: The case of a single leaking munition is addressed in chapter 14 on ROTA.

SECTION II - PREDICTION OF THE DOWNWIND HAZARD

1208. Chemical Hazards

1. After an attack by chemical agents 3 types of hazard can be encountered by personnel dependent on their position relative to the attack area. These are a liquid hazard, a vapour hazard or both a liquid and a vapour hazard.

a. **Liquid Hazard**.
Personnel in an area contaminated with liquid chemical agents will be exposed to a hazard that varies according to:
- The type and amount of agent disseminated.
- The method of dissemination.
- The local climatic conditions.
- The nature of the terrain.
- The time lapse after the contamination.

Liquid agents may under very cold conditions completely stop evaporating and result in an all clear survey. A hazard can be recreated when temperatures rise.

(1) Non Persistent Agents. Most non persistent agents are disseminated mainly as vapour, but some of the agent types may leave unevaporated liquid in shell or bomb craters for either hours or days depending upon the climatic conditions and the munition type. Craters should be avoided until tests have proved the absence of a liquid hazard.

(2) Persistent Agents. Persistent agents are disseminated as liquid and present a vapour hazard as well as a contact hazard. This hazard will last for several hours to days depending on the terrain, climatic conditions and munition type.

(3) Border areas. Some agents normally classified as non persistent may behave as persistent agents in very cold environments, and liquid from both non persistent and persistent agents may freeze at low temperatures e.g. HD freezes at temperatures below 14°C, and can present a delayed hazard to personnel when the temperature rises.
Thickened, non persistent agents may have to be treated as persistent, ground contaminating agents. Blister agents are normally classified as persistent agents and will be so indicated when detected by three way detection paper. Some agents however, are very volatile and should be treated as non persistent, but still ground contaminating agents.

b. **Vapour Hazard**.
All chemical agents present a vapour or aerosol hazard to personnel downwind of the attack area. The area covered by this hazard may be estimated by using prediction techniques.
The actual downwind distance covered by a toxic cloud will depend on the type and amount of agent disseminated, the method of dissemination, the climatic conditions and the terrain.

1209. Chronology

1. Unprotected personnel in an attack area will be exposed to the chemical agent hazards unless they take immediate protective action at the first indication of an attack.

2. The dimensions of the downwind hazard area will depend on the means of delivery, the category of agent, the type of attack, and on weather and terrain. The cloud arrival time at positions downwind of the attack point or area will depend on the **downwind speed**.

3. The ability to provide timely warning to personnel downwind of the point or area of attack, will depend on the time taken to learn of the attack, the time taken to predict a downwind hazard area and the time required to transmit the warning to those in the hazard area.

1210. Principles and Limitations

1. It is assumed, that once chemical warfare has been initiated, troops in areas attacked by aircraft or missiles, or coming under artillery or other bombardments, will immediately and automatically carry out appropriate chemical defence drills, whether or not a chemical alarm has been given.

2. An attacked unit will attempt to warn all friendly forces in the immediate vicinity, using the procedures prescribed in STANAG 2047 (Emergency Alarms of Hazard or Attacks (NBC and air attacks only)).

3. In fixed installations, and in other cases, where established communications and/or alarms are available, these can also be used.

4. Units and installations warned in this way should not promulgate the alarm beyond their own area.

Note: As soon as a commander/NBC centre realises that completion and submission of a NBC 3 CHEM would not warn a unit in the hazard area in time, he/it will attempt to pass the alarm by the most expeditious means available.

5. Simultaneously, a report of the attack should be made to the NBC Collection/Sub Collection Centre. This immediate report will be followed by a formatted NBC report, in accordance with Chapter 2 or Annex D.

6. The NBC Collection/Sub Collection Centre will use this information to provide timely warning to units and/or installations in the predicted downwind hazard area. Due to climatic and geographical variations, the lateral limits of the predicted hazard area are normally to be defined by an angle of lateral spread 30° on either side of the forecast downwind direction. If more detailed information is available, use Annex E.

7. The hazard area prediction will be less reliable as the distance from the point of emission increases.

8. Units in the downwind hazard area, warned by a NBC Collection/Sub Collection Centre, will not raise an alarm outside their own area, but will submit a NBC 4 CHEM in accordance with SOPs on the actual arrival of the chemical agent cloud.

9. The limiting dosages of agents assumed in establishing the procedures for hazard area prediction, while not sufficient to produce casualties immediately, may produce later effects, i.e. miosis from nerve agents.

10. Simplified procedures for obtaining Downwind Hazard Distance is contained in Table 12-I. If More detailed information on agent effective payload and meteorological is available, use Annex E to obtain a more detailed downwind hazard estimate.

11. A munition found leaking or suspected leaking on the battlefield is to be reported in a NBC 1 ROTA.

1211. Type "A" Attack Downwind Hazard Prediction

1. The following information is required:

   -. NBC 1 CHEM or NBC 2 CHEM, and

   -. detailed MET information e.g. NBC Chemical Downwind Message (NBC CDM), or similar information.

Note: If detailed MET information is not available, the air stability category should be determined by using Table 15 - I, and this category should be adjusted using Table 15 - II. The **downwind direction** and **downwind speed** must be measured locally.

a. **Type "A", Case "1". (<u>NOT TO SCALE)</u>**

Example NBC 3 CHEM
ALFA/UK/A234/001/C//
DELTA/271630ZAPR1999//
FOXTROT/33UUB206300/AA//
INDIA/SURF/NERV/NP//
PAPAA/01KM/-/10KM/-//
PAPAX/271600ZAPR1999/-//
YANKEE/105DGT/009KPH//
ZULU/4/18C/9/-/2//
GENTEXT/NBCINFO/TYPE A, CASE 1//

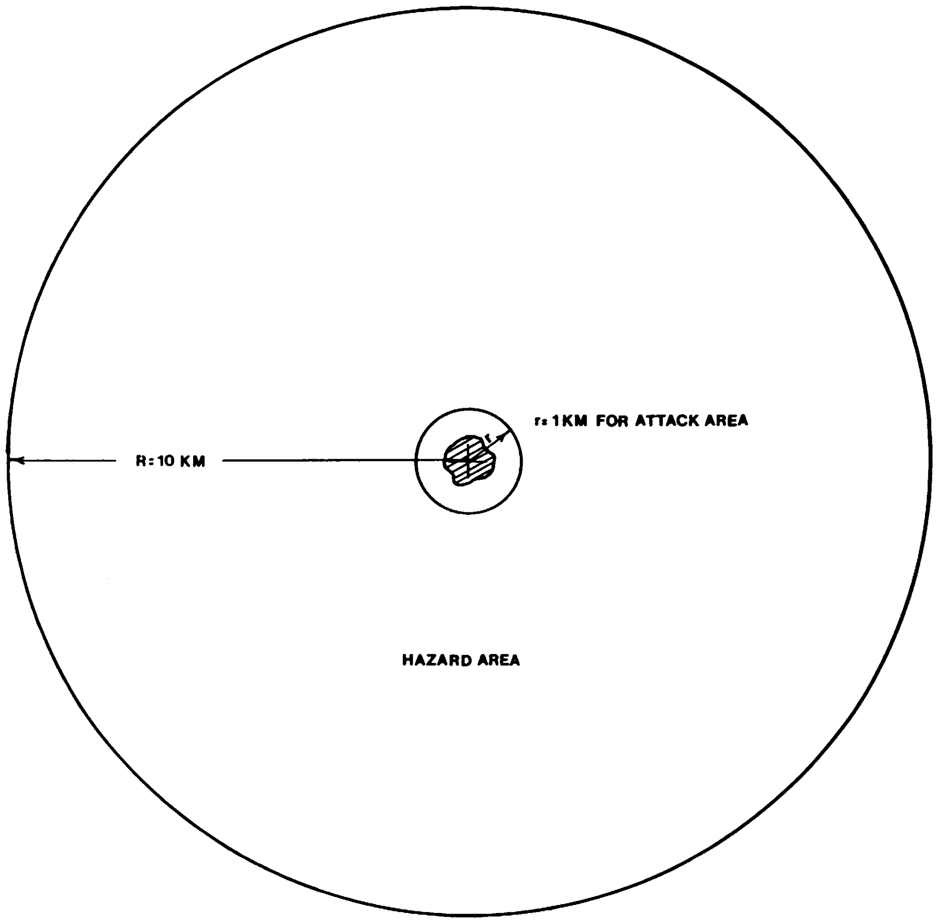


Figure 12-I, Hazard Area from Type "A" Attack, Case "1" . Wind Speed 10 KPH or Less.

(1) Obtain the location of the attack from the relevant NBC CHEM message(s) and plot it on the map. (Figure 12 - I).
(2) Draw a circle, radius 1 km, around the centre of the attack location. The area within this circle represents the attack area.
(3) Draw a circle, radius 10 km, around the centre of the attack location. The area within this circle represents the hazard area.
(4) Prepare and transmit NBC 3 CHEM to those units and installations within the hazard area in accordance with SOPs.

b. **Type "A", Case "2". (NOT TO SCALE)**

Example NBC 3 CHEM
ALFA/UK/A234/003/C//
DELTA/271647ZAPR1999//
FOXTROT/32UPG560750/AA//
INDIA/AIR/NERV/NP//
PAPAA/01KM/-/10KM/-//
PAPAX/271600ZAPR1999/
32UPG674791/
32UPG557759/
32UPG550752/
32UPG552742/
32UPG638657//
YANKEE/105DGT/015KPH//
ZULU/2/15C/8/-/2//
GENTEXT/NBCINFO/TYPE A, CASE 2, DHD 10KM//

Note: In order that a recipient of a NBC 3 CHEM be able to plot the downwind hazard easily and quickly, set GENTEXT/NBCINFO may contain the type, case and the downwind hazard distance (DHD).

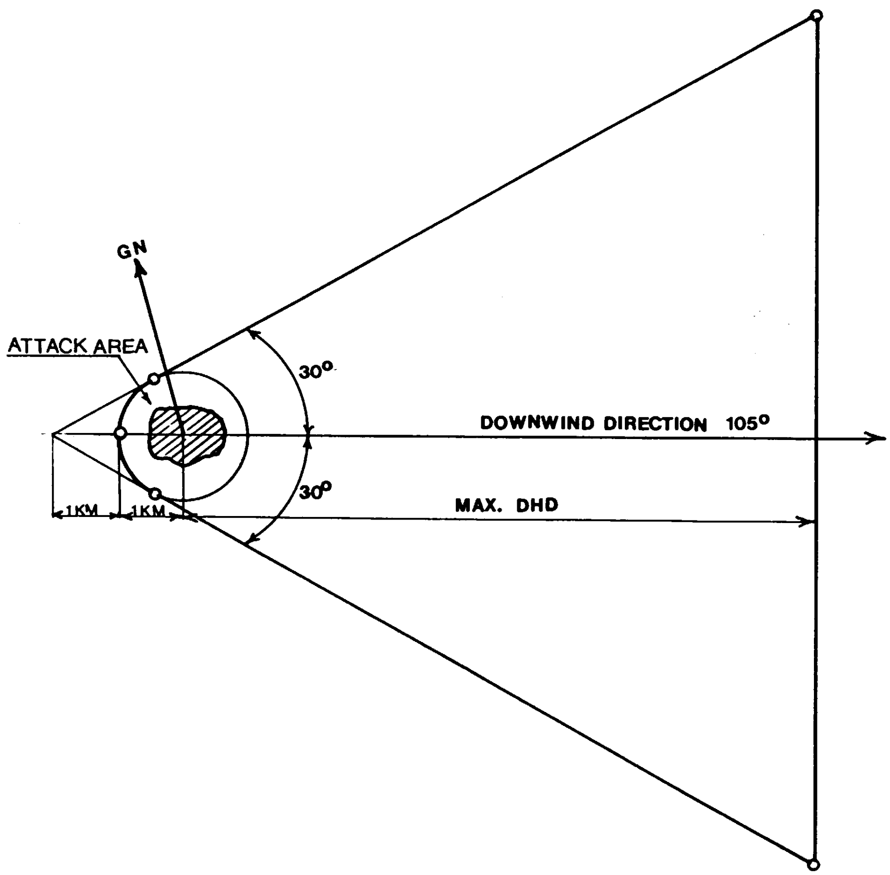


Figure 12-II, Hazard Area from Type "A" Attack, Case "2". Wind Speed more than 10 KPH.

(1) Obtain the location of the attack from the relevant NBC CHEM message(s) and plot it on the map. (Figure 12 - II).
(2) From the centre of the attack location, draw a Grid North line (GN Line).
(3) Draw a circle, radius 1 km, around the centre of the attack location. The area within this circle represents the attack area.
(4) Using the valid NBC CDM, or from locally measured data, identify the air stability category (Table 15 - I and 15 - II), the downwind direction and the downwind speed.
(5) From the centre of the attack area, draw a line showing the downwind direction.
(6) Determine the Downwind Hazard Distance.

- Simplified procedure; if no more detailed information is available, go to Table 12 - I using the appropriate air stability category and means of delivery.

- Detailed procedure; if more detailed information is available regarding agent type, means of delivery and wind speed use the tables in Annex E or the equations in AEP-45, Appendix D-26.

Note: When information concerning means of delivery is not available, use the figures for multiple launched rocket systems, missiles, bombs and unknown munitions.

(7) Plot the maximum downwind distance from the centre of the attack area on the downwind line.
(8) From the maximum downwind distance, draw a line at right angles to the downwind direction line. Extend the line either side of the downwind direction line.
(9) Extend the downwind line, upwind from the centre of the attack area, 2 km. This is equal to twice the radius of the attack area.
(10) From the upwind end of this line, draw 2 lines, which are tangents to the attack area circle, and extend them until they intersect with the maximum downwind distance line. (See (8) above). These lines will form a 30° angle either side of the downwind line.
(11) The hazard area is taken to be the area bounded by:

(a) The upwind edge of the attack area circle.
(b) The two 30° tangents.
(c) The maximum downwind distance line. See Figure 12 - II.

(12) Prepare and transmit NBC 3 CHEM to units and installations in the predicted hazard area in accordance with SOPs.

c. To estimate the earliest and latest arrival times of the chemical cloud at a certain point, calculate the speeds that the leading and trailing edges of the chemical cloud will travel by:

Leading Edge Speed = Downwind Speed x 1.5

$$\textbf{Earliest arrival time} = \frac{\textbf{Distance to point}}{\textbf{Leading edge speed}}$$

The distance to the points considered must be measured from the downwind edge (outer edge for Case “1”) of the attack area.

Trailing Edge Speed = Downwind Speed x 0.5

$$\textbf{Latest arrival time} = \frac{\textbf{Distance to point}}{\textbf{Trailing edge speed}}$$

The distance to the points considered must be measured from the upwind edge (circle centre for Case “1”) of the attack area.

1212. Type "B" Attack Downwind Hazard Prediction

1. The following information is required:
   - NBC 1 CHEM or NBC 2 CHEM, and
   - The daily mean surface temperature.
   - Detailed Met information e.g. NBC CDM, or similar information.

2. The daily mean surface temperature is needed for the estimation of the probable time after which personnel may safely remove their respirators. (Table 12 - II).

3. The air stability category is not considered in Type "B" hazard prediction as the maximum downwind distance is always 10 km.

a. Type "B", Case "1". (**<u>NOT TO SCALE)</u>**

Example NBC 3 CHEM
ALFA/UK/A234/001/C//
DELTA/271630ZAPR1999//
FOXTROT/33UUB206300/AA//
INDIA/SURF/NERV/P//
PAPAA/01KM/-/10KM/-//
PAPAX/271600ZAPR1999/-//
YANKEE/105DGT/009KPH//
ZULU/4/18C/9/-/2//
GENTEXT/NBCINFO/TYPE B, CASE 1//

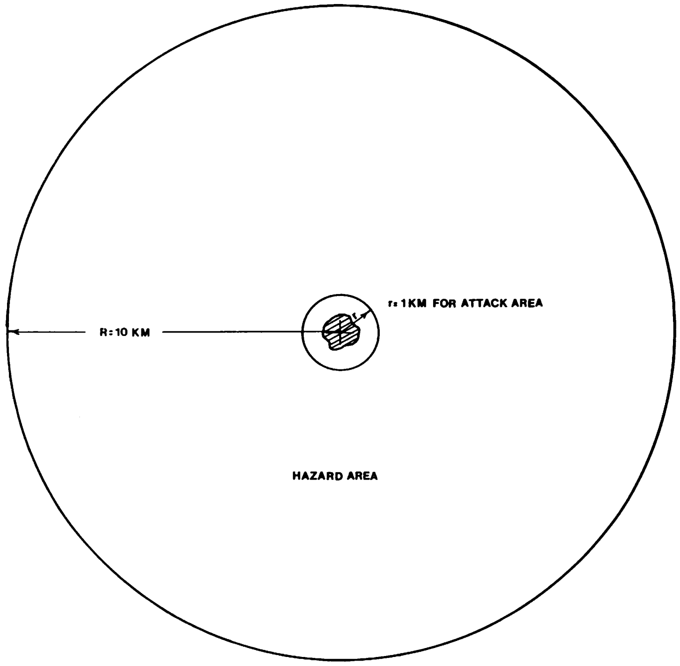


Figure 12-III, Hazard Area from Type "B" Attack, Case "1".
Wind Speed 10 KPH or Less.

(1) Obtain the location of the attack from the relevant NBC CHEM message(s) and plot it on the map. (Figure 12 - III).

(2) Draw a circle, radius 1 km, around the centre of the attack location. The area within this circle represents the attack area.

(3) Draw a circle, radius 10 km, around the centre of the attack location. The area within this circle represents the hazard area.

(4) Prepare and transmit NBC 3 CHEM to those units and installations within the hazard area in accordance with SOPs.

b. Type "B", Case "2". (<u>NOT TO SCALE)</u>

Example NBC 3 CHEM

ALFA/UK/A234/011/C//
DELTA/271650ZAPR1999//
FOXTROT/32UNH250010/AA//
INDIA/AIR/NERV/P//
PAPAA/01KM/2-4DAY/10KM/1-2DAY//
PAPAX/271600ZAPR1999/
        32UNH371020/
        32UNH250020/
        32UNH241015/
        32UNH241005/
        32UNG301900//
YANKEE/120DGT/015KPH//
ZULU/2/15C/8/-/2//
GENTEXT/NBCINFO/TYPE B, CASE 2//

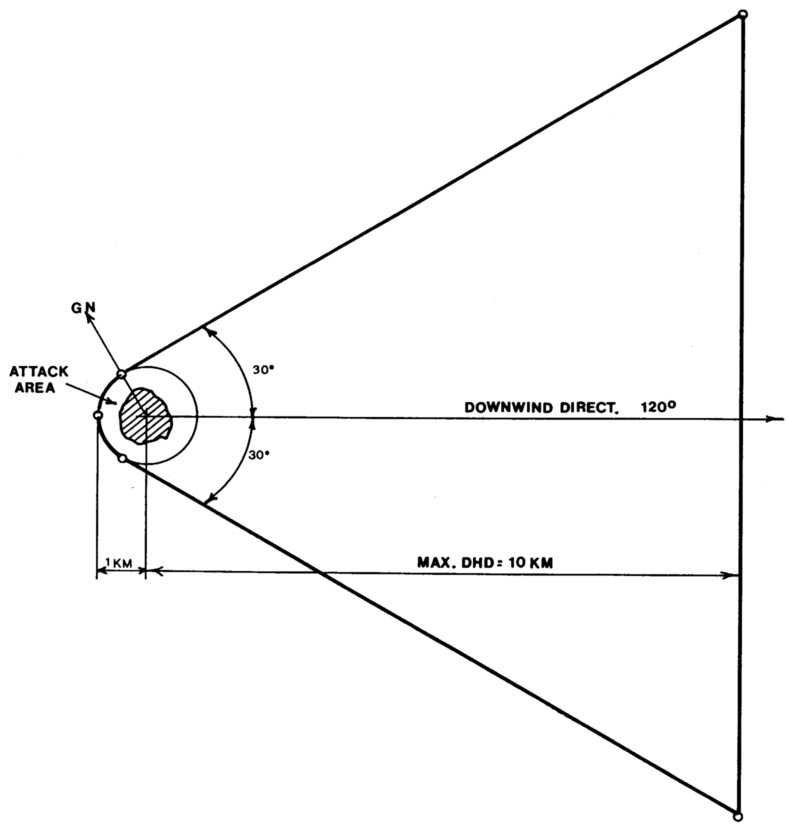


Figure 12-IV, Hazard Area from Type "B" Attack, Case "2". Radius of Attack Area equal to 1 km. Wind Speed more than 10 KPH.

(1) Obtain the location of the attack from the relevant NBC CHEM message(s) and plot it on the map. (Figure 12 - IV).

(2) From the centre of the attack location, draw a Grid North line (GN Line).

(3) Draw a circle, radius 1 km, around the centre of the attack location. The area within this circle represents the attack area.

(4) From the centre of the attack area, draw a line showing the downwind direction.

(5) Plot the 10 km downwind distance from the centre of the attack area on the downwind line.

(6) From the 10 km downwind distance, draw a line at right angles to the downwind direction line. Extend the line either side of the downwind direction line.

(7) Extend the downwind line, upwind from the centre of the attack area, 2 km. This is equal to twice the radius of the attack area.

(8) From the upwind end of this line, draw 2 lines which are tangents to the attack area circle, and extend them until they intersect with the 10 km downwind distance line. (See (6) above). These lines will form a 30° angle either side of the downwind line.

(9) Using Table 12 - II, find the probable time after ground contamination at which personnel may safely remove their respirators.

(10) Prepare and transmit NBC 3 CHEM to units and installations in the predicted hazard area in accordance with SOPs.

c. Type "B", Case "3". <u>(NOT TO SCALE)</u>

Example NBC 3 CHEM
ALFA/UK/A234/013/C//
DELTA/211605ZAPR1999//
FOXTROT/32UNH431562/EE//
GOLF/OBS/MSL/10/-/-//
INDIA/AIR/NERV/P//
PAPAA/02KM/2-4DAY/010KM/1-2DAY//
PAPAX/211500ZAPR1999/-//
YANKEE/105DEG/8KPH//
ZULU/2/15C/6/-/2//
GENTEXT/NBCINFO/TYPE B, CASE 3//

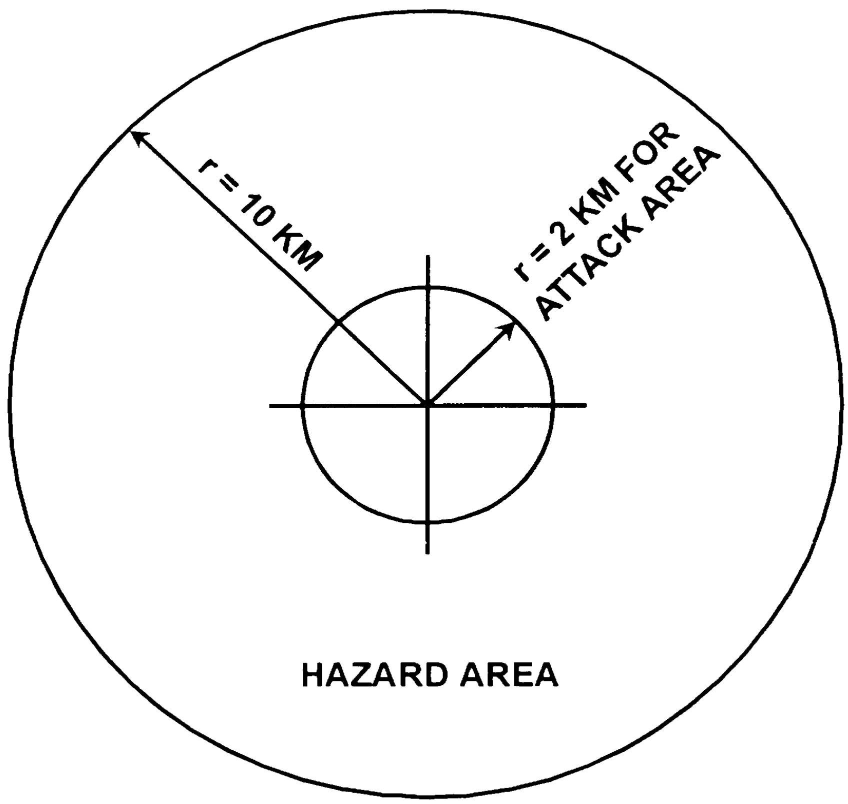


Figure 12-V, Hazard Area from a Type "B", Case "3". Attack Area Radius equal to 2 km . Wind Speed $\leq$ 10 KPH.

(1) Obtain the location of the attack from the relevant NBC CHEM message(s) and plot it on the map. (Figure 12 - V).
(2) Draw a circle, radius 2 km, around the centre of the attack location. The area within this circle represents the attack area.
(3) Draw a circle, radius 10 km, around the centre of the attack location. The area within this circle represents the hazard area.
(4) Prepare and transmit NBC 3 CHEM to those units and installations within the hazard area in accordance with SOPs.

d. Type "B", Case "4". (<u>NOT TO SCALE)</u>

Example NBC 3 CHEM
ALFA/UK/A234/006/C//
DELTA/181730ZAPR1999//
FOXTROT/32UNH320010/EE//
INDIA/AIR/NERV/P//
PAPAA/02KM/2-4DAY/10KM/1-2DAY//
PAPAX/181600ZAPR1999/
32UNH441051/
32UNH316029/
32UNH301016/
32UNG304997/
32UNG386899//
YANKEE/110DGT/020KPH//
ZULU/4/16C/-/-/2//
GENTEXT/NBCINFO/TYPE B, CASE 4//

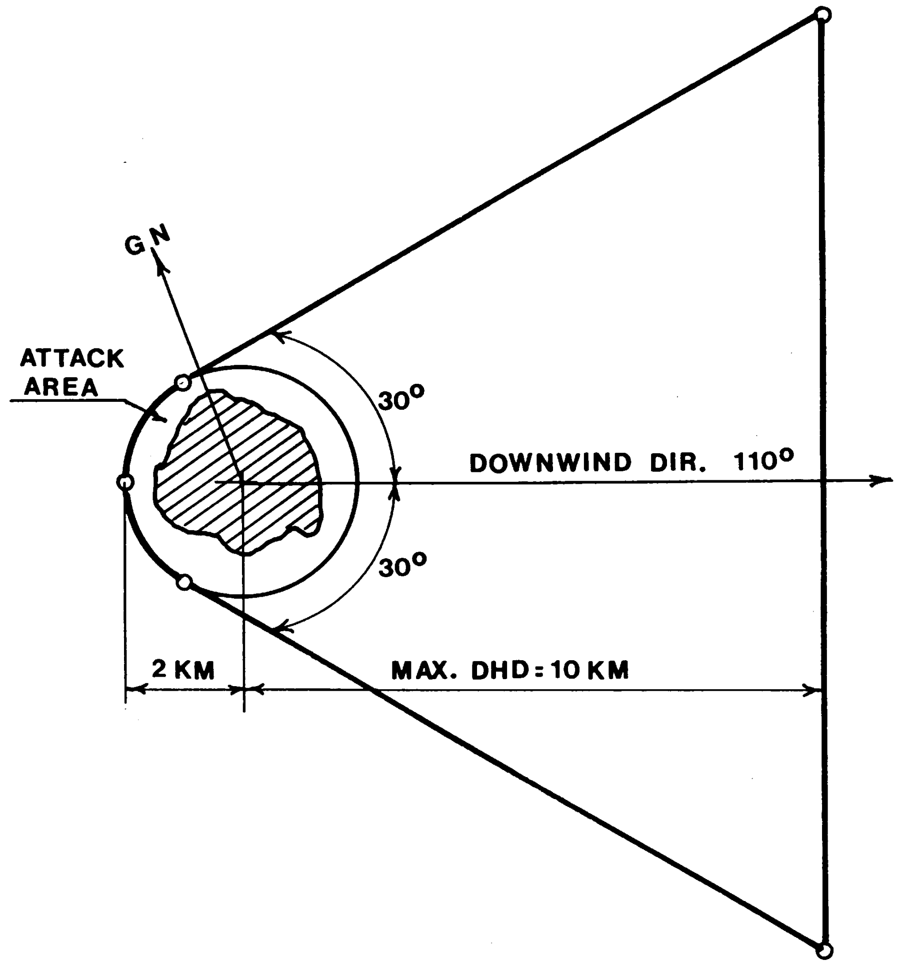


Figure 12-VI, Hazard Area from Type "B" Attack, Case "4". Attack Area Radius equal to 2 km. Wind Speed more than 10 KPH.

(1) Obtain the location of the attack from the relevant NBC CHEM message(s) and plot it on the map. (Figure 12 - VI).

(2) Estimate the centre of the attack area, and draw a circle, radius 2 km around that centre point.

(3) From the centre of the attack area, draw a Grid North line (GN Line).

(4) From the centre of the attack area, draw a line showing the downwind direction.

(5) Plot the 10 km downwind distance from the centre of the attack area on the downwind line.

(6) From the 10 km downwind distance, draw a line at right angles to the downwind direction line. Extend the line either side of the downwind direction line.

(7) Extend the downwind line, upwind from the centre of the attack area, 4 km. This is equal to twice the radius of the attack area.

(8) From the upwind end of this line, draw 2 lines, which are tangents to the attack area circle, and extend them until they intersect with the 10 km downwind distance line. (See (6) above). These lines will form a 30° angle either side of the downwind line.
(9) Using Table 12 - II, find the probable time after ground contamination at which personnel may safely remove their respirators.
(10) Prepare and transmit NBC 3 CHEM to units and installations in the predicted hazard area in accordance with SOPs.

e. Type "B", Case "5". (<u>NOT TO SCALE)</u>

Example NBC 3 CHEM
ALFA/UK/A234/014/C//
DELTA/201530ZAPR1999//
FOXTROT/32UNG420620/EE/
32UNG435620/EE//
INDIA/AIR/NERV/P//
PAPAA/01KM/2-4DAY/010KM/1-2DAY//
PAPAX/211500ZAPR1999/-//
YANKEE/147DGT/009KPH//
ZULU/2/15C/6/-/2//
GENTEXT/NBCINFO/TYPE B, CASE 5//

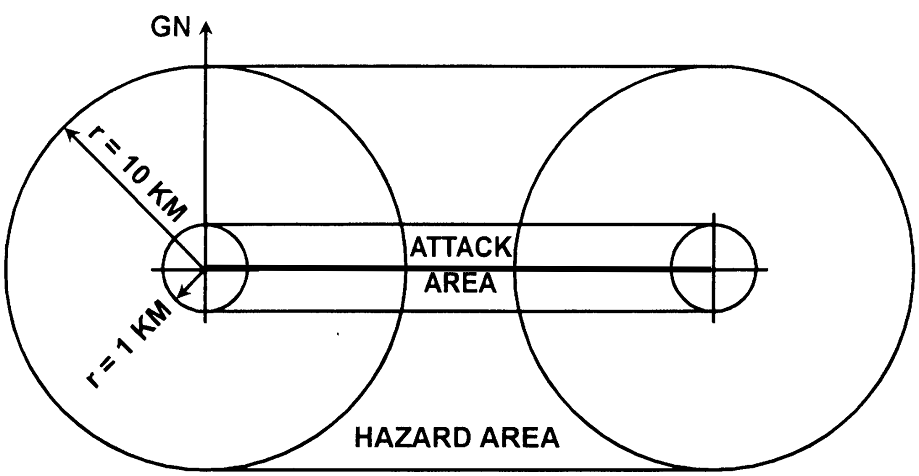


Figure 12-VII, Hazard Area from Type "B", Case "5".
Any Dimension of Attack Area greater than 2 km. Wind Speed ≤ 10 KPH.

(1) Estimate the attack area from a NBC 1 CHEM or NBC 2 CHEM and plot a point at each extreme end.
(2) Connect the end points to form one or more attack lines.
(3) Draw a 1 km radius circle around each end point.
(4) Connect these circles on both sides by drawing tangents to the circles parallel to the attack line, to designate the attack area.

(5) Draw a 10 km radius around each 1 km circle at the end points.

(6) Connect these circles on both sides by drawing tangents to the circles parallel to the attack line, to designate the hazard area.

(7) Prepare and transmit NBC 3 CHEM messages to units and installations within the hazard area in accordance with SOPs.

f. Type "B", Case "6". (NOT TO SCALE)

Example NBC 3 CHEM

ALFA/UK/A234/007/C//
DELTA/141550ZAPR1999//
FOXTROT/33UUC330060/EE/
    33UUC370061/EE//
INDIA/AIR/NERV/P//
PAPAA/01KM/2-4DAY/10KM/1-2DAY//
PAPAX/141400ZAPR1999/
    33UUC482014/
    33UUC374069/
    33UUC368070/
    33UUC328069/
    33UUC320059/
    33UUB326938/
    33UUB366939//
YANKEE/147DGT/012KPH//
ZULU/4/18C/3/-/0//
GENTEXT/NBCINFO/TYPE B, CASE 6//

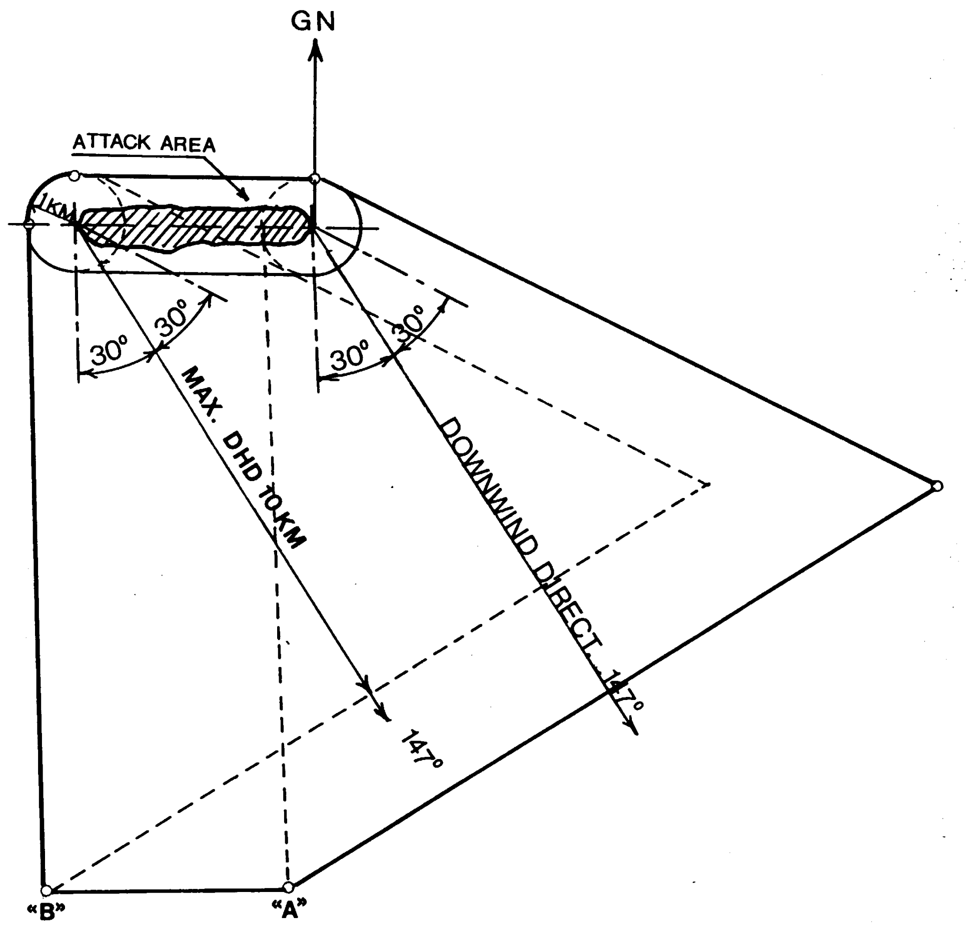


Figure 12-VIII, Hazard Area from Type "B" Attack, Case "6".
Any Dimension of Attack Area greater than 2 km. Wind Speed more than 10 KPH.

(1) Estimate the attack area from the NBC 1 CHEM or NBC 2 CHEM and plot it on a map. (Figure 12 - VIII).

(2) Identify and mark the extremities of the estimated attack area, and connect the end points to form one or more attack lines.

(3) Using the extremities as centre points, draw circles, radius of 1 km, around each point. Connect these circles on both sides by drawing tangents to the circles parallel to the attack line, to designate the attack area.

(4) Draw a Grid North line from the centre of each circle.

(5) Consider each circle as a separate attack area and carry out the following procedure for each attack area:

(a) From the centre of the attack area, draw a line showing the downwind direction.

(b) Plot the 10 km downwind distance from the centre of the attack area on the downwind line.

(c) From the 10 km downwind distance, draw a line at right angles to the downwind direction line. Extend the line either side of the downwind direction line.

(d) Extend the downwind line, upwind from the centre of the attack area, 2 km. This is equal to twice the radius of the attack area.

(e) From the upwind end of this line, draw 2 lines, which are tangents to the attack area circle, and extend them until they intersect with the 10 km downwind distance line. (See (5) (c) above). These lines will form a 30° angle either side of the downwind line.

(f) Draw a line connecting the downwind corners of the 2 vapour hazard areas (Points "A" and "B" in Figure 12 - VIII).

(6) Using Table 12 - II, find the probable time after ground contamination at which personnel may safely remove their respirators.

(7) Prepare and transmit NBC 3 CHEM to units and installations in the predicted hazard area in accordance with SOPs.

g. To estimate the earliest arrival time of the chemical cloud at a certain point, calculate the fastest speed that the leading edge of the chemical cloud will travel by:

Fastest Speed = Downwind Speed x 1.5.

$$\text{Earliest arrival time} = \frac{\textbf{Distance to point}}{\text{Fastest speed}}$$

The distance to the point considered must be measured from the downwind edge (outer edge for Case “1”) of the attack area.

1213. Type “C” Attack Downwind Hazard Prediction

a. Type "C". (NOT TO SCALE)

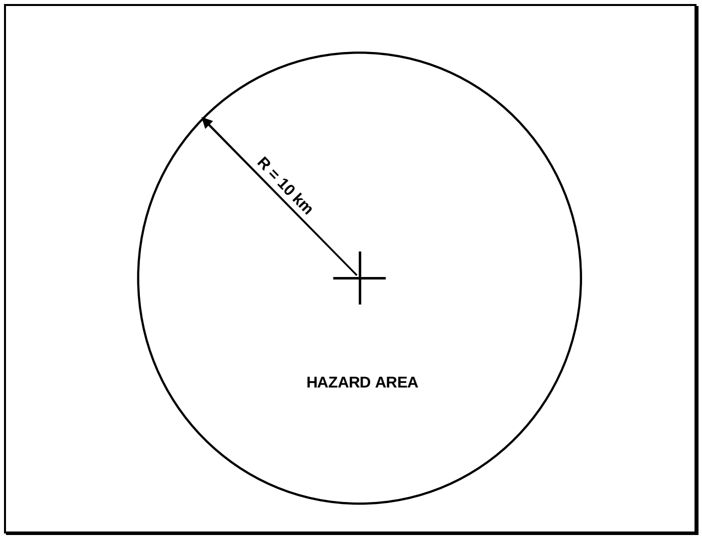


Figure 12-IX. Type "C".

(1) Obtain the location of detection from the relevant NBC 4 CHEM message (set QUEBEC) and then plot it on the map. (Figure 12 - IX).
(2) Draw a circle with a 10 km radius around the centre of the detection location. The area within this circle represents both the attack area and the hazard area.
(3) Prepare and transmit a NBC 3 CHEM to units and installations in the predicted hazard area in accordance with SOPs.
(4) If a new NBC 4 CHEM message, that cannot be allocated to a strike, specifies a location outside of the hazard area, repeat procedures for the new location.

1214. Procedures for Recalculation of Predicted Downwind Hazard Areas after Significant Weather Changes

1. NBC 3 CHEM messages must be revised when significant weather changes are considered to have occurred.

2. These are:

a. A change in the air stability category. This applies only to Type "A" case "2" attacks.

b. The downwind direction changes by 30 degrees or more.

c. The wind speed:

(1) Changes by 10 KPH or more (Type A, case 2 only).
(2) Increases from less than or equal to 10 KPH to more than 10 KPH.
(3) Decreases from more than 10 KPH to less than or equal to 10 KPH.

Should any of the 3 situations above occur, then the downwind hazard plots and the associated NBC 3 CHEM messages must be revised. Combinations of changes may occur. NBC trained personnel must then find solutions in accordance with the principles listed below.

d. **Calculation of the Maximum Downwind Hazard Distances**. When significant weather changes occur, or are predicted, the following procedure for type "A" attacks should be used to determine:

(1) The distance the chemical agent cloud will have travelled prior to the change by using:

$\mathbf{d_1} = \mathbf{u_1 \times t_1}$

$\mathbf{d_1}$ = distance travelled prior to change in weather conditions.

$\mathbf{u_1}$ = downwind speed prior to change in weather conditions.

$\mathbf{t_1}$ = time elapsed between the time of attack and the end of the current CDR time period.

Note: If the distance travelled, as calculated above, is equal to or exceeds the original maximum downwind hazard distance, then recalculation is not required.

(2) For Type “A” case “2” attacks, measure the distance $\mathbf{d_1}$ along the downwind line and mark it. If that point is outside of the current CDR area, get the CDR for the area containing the new point and get the weather conditions for the next time period. Compare these weather conditions with those used for the current CDR time period and determine if significant weather changes are predicted.

(3) The distance the chemical cloud will travel after the change by using:

$\mathbf{d_2} = \mathbf{H_2 - d_1}$

$\mathbf{d_2}$ = remaining hazard distance.

$\mathbf{H_2}$ = maximum hazard distance under the conditions prevailing after the change.

$\mathbf{d_1}$ = distance travelled prior to change in weather conditions.

Note 1: If the second time period has a wind speed ≤ 10 kph (type A1), always draw a circle with a radius of 10 km (as if $\mathbf{d_2}$ = 10 km)

Note 2: In constructing the hazard area, it must be kept in mind that the maximum hazard distance, valid during either set of weather conditions, must not be exceeded. If $\mathbf{d_2 \leq 0}$, recalculation is not required.

e. Type "A", Case "1" changing to a Type "A", Case "2". (Increase in wind from ≤ 10 KPH to > 10 KPH). (NOT TO SCALE)

Example NBC CDM
AREAM/NFEA12//
ZULUM/230600ZAPR1999/230900ZAPR1999/
231500ZAPR1999//
UNITM/KM/DGT/KPH/C//
WHISKEYM/140/008/4/06/8/-/2//
XRAYM/140/012/4/10/8/-/2//
YANKEEM/150/014/4/14/8/-/2//

Example NBC 2 CHEM
ALFA/UK/A234/005/C//
DELTA/231030ZAPR1999//
FOXTROT/32VNH450956/AA//
GOLF/OBS/CAN/-/SHL/24//
INDIA/SURF/NERV/NP//
TANGO/FLAT/SCRUB//
YANKEE/140DGT/008KPH//
ZULUA/4/10C/8/-/2//
GENTEXT/NBCINFO/
TYPE OF AGENT
CONFIRMED BY CHEMICAL
DETECTION KIT.
RECALCULATION BASED
ON CHANGE IN WIND
SPEED 231100Z//

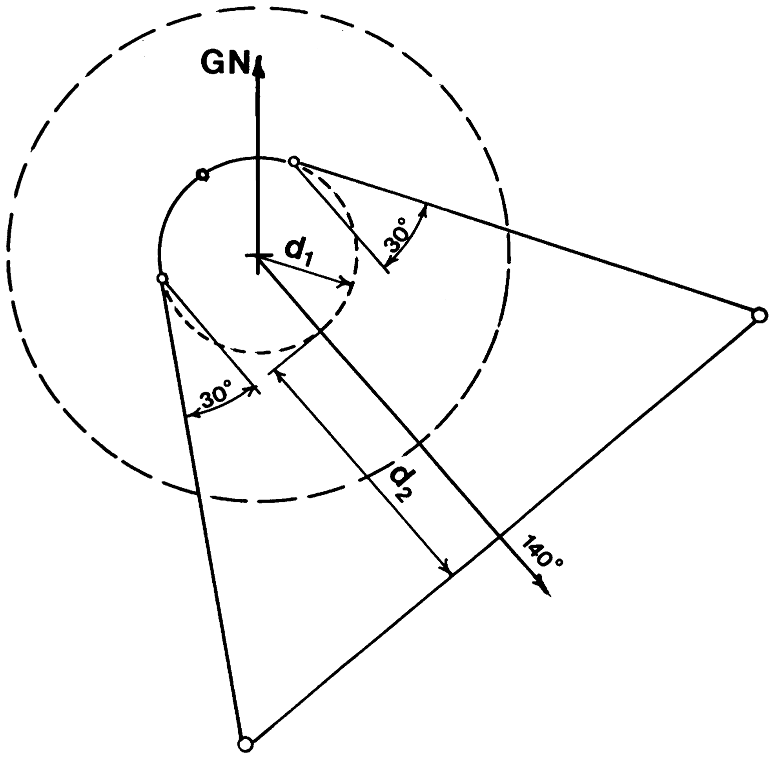


Figure 12-X, Recalculation of Downwind Hazard Area.
Type "A" Attack, change in Wind Speed from ≤ 10 KPH to > 10 KPH.

(1) Calculate $\mathbf{d_1}$.
(2) Draw a circle around the centre of the original attack area. Radius $\mathbf{d_1}$. The area inside this circle represents the new attack area.

Note: If $\mathbf{d_1}$ > 10 km then use: $\mathbf{d_1}$ = 10 km.

(3) From the centre of the attack area, draw a line showing the downwind direction.
(4) From the centre of the attack draw a Grid North line.
(5) From where the downwind direction line cuts the new attack area circle, measure and mark the distance $\mathbf{d_2}$ on the downwind direction line.
(6) From the $\mathbf{d_2}$ distance, draw a line at right angles to the downwind direction line, and extend it either side of the downwind direction line.
(7) Extend the downwind line, upwind from the centre of the attack area by **2 x** $\mathbf{d_1}$. This is equal to twice the radius of the new attack area.
(8) From the upwind end of this line, draw 2 lines which are tangents to the new attack area circle, and extend them until they intersect with the right angle line resulting from e.(6).

(9) Prepare and transmit the revised NBC 3 CHEM to units and installations in the new predicted hazard area.

f. Type "A", Case "2" changing to a Type "A", Case "1". (Decrease in Wind from > 10 KPH to ≤ 10 KPH). (<u>NOT TO SCALE)</u>

Example NBC CDM
AREAM/NFEB43//
ZULUM/281200ZAPR1999/281500ZAPR1999/
282100ZAPR1999//
UNITM/KM/DGT/KPH/C//
WHISKEYM/090/018/4/14/8/-/2//
XRAYM/090/008/4/10/8/4/2//
YANKEEM/090/006/2/06/8/4/2//

Example NBC 2 CHEM
ALFA/UK/A234/005/C//
DELTA/281615ZAPR1999//
FOXTROT/32UPG387764/AA//
GOLF/OBS/MLR/-/RKT/12//
INDIA/SURF/NERV/NP//
TANGO/FLAT/SCRUB//
YANKEE/090DGT/018KPH//
ZULUA/4/14C/8/-/2//
GENTEXT/NBCINFO/
SYMPTOMS OF NERVE
AGENT POISONING.
RECALCULATION BASED
ON CHANGE IN WIND
SPEED AS OF 281700Z//

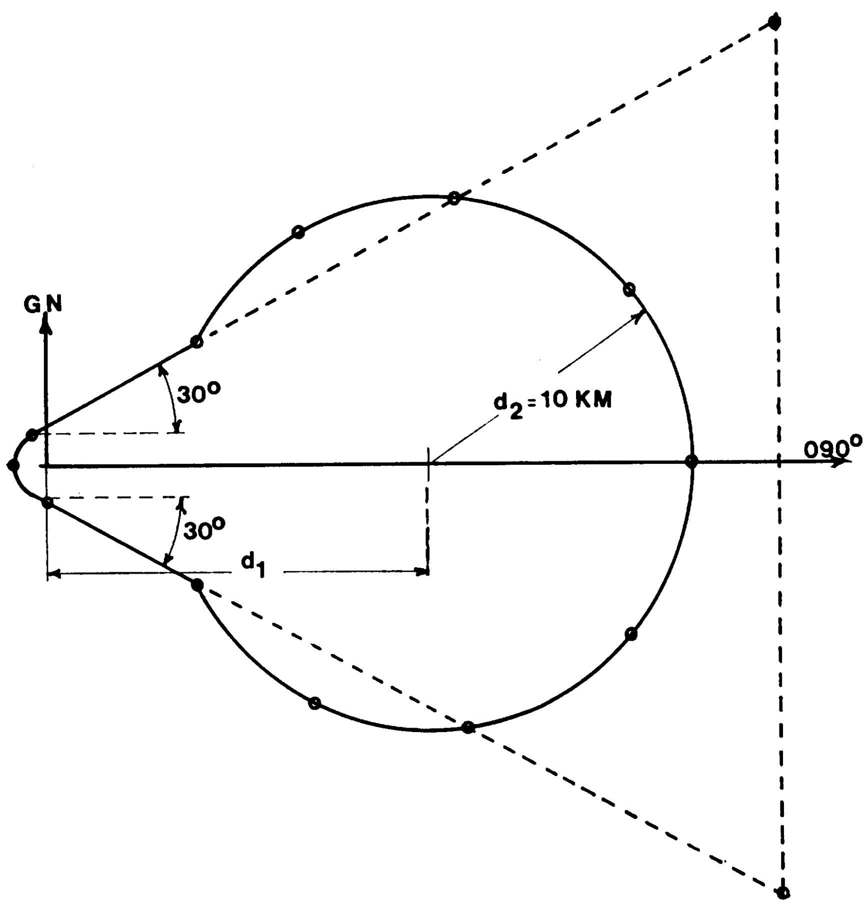


**Figure 12-XI(a), Recalculation of Downwind Hazard Area.
Type "A" Attack, change in Wind Speed from > 10 KPH to ≤ 10 KPH.**

Example NBC CDM
AREAM/NFEA12//
ZULUM/280600ZAPR1999/280900ZAPR1999/
281500ZAPR1999//
UNITM/KM/DGT/KPH/C//
WHISKEYM/120/014/4/06/8/-/2//
XRAYM/120/009/4/10/8/-/2//
YANKEEM/130/007/4/14/8/-/2//

Example NBC 2 CHEM
ALFA/UK/A234/009/C//
DELTA/281030ZAPR1999//
FOXTROT/32UMG892764/AA//
GOLF/OBS/MLR/-/RKT/6//
INDIA/SURF/NERV/NP//
TANGO/FLAT/SCRUB//
YANKEE/120DGT/14KPH//
ZULU/4/06C/8/-/2//
GENTEXT/NBCINFO/
RECALCULATION BASED
ON CHANGE IN WIND
SPEED AS OF 281100Z//

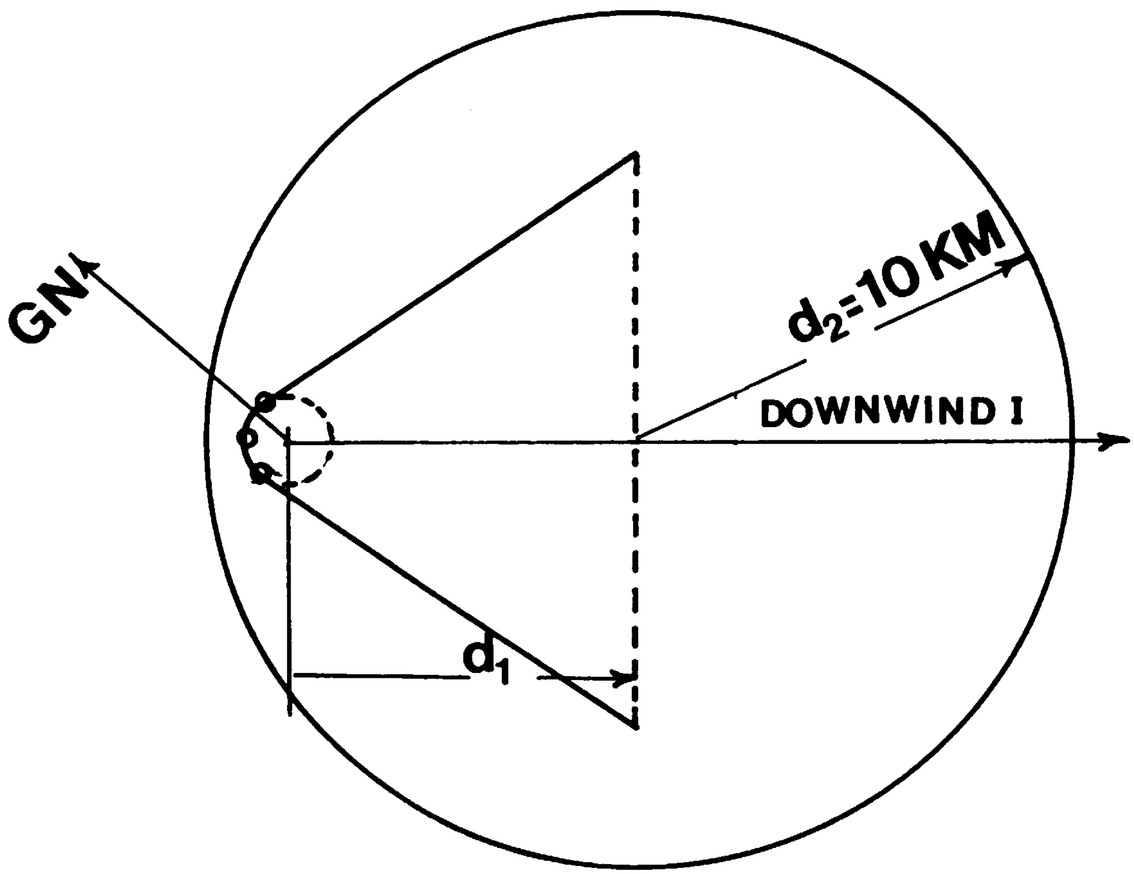


Figure 12-XI(b), Recalculation of Downwind Hazard Area.
Type "A" Attack, change in Wind Speed from > 10 KPH to ≤ 10 KPH.

Example NBC CDM
AREAM/NFEA12//
ZULUM/280600ZAPR1999/280900ZAPR1999/
281500ZAPR1999//
UNITM/KM/DGT/KPH/C//
WHISKEYM/120/014/4/06/8/-/2//
XRAYM/120/009/4/10/8/-/2//
YANKEEM/130/007/4/14/8/-/2//

Example NBC 2 CHEM
ALFA/BE/1BDE/013/C//
DELTA/280930ZAPR1999//
FOXTROT/32UMG892764/AA//
GOLF/OBS/MLR/-/RKT/6//
INDIA/SURF/NERV/NP//
TANGO/FLAT/SCRUB//
YANKEE/120DGT/014KPH//
ZULU/4/06C/8/-/2//
GENTEXT/NBCINFO/
RECALCULATION BASED ON
CHANGE IN WIND SPEED AS OF
281100Z//

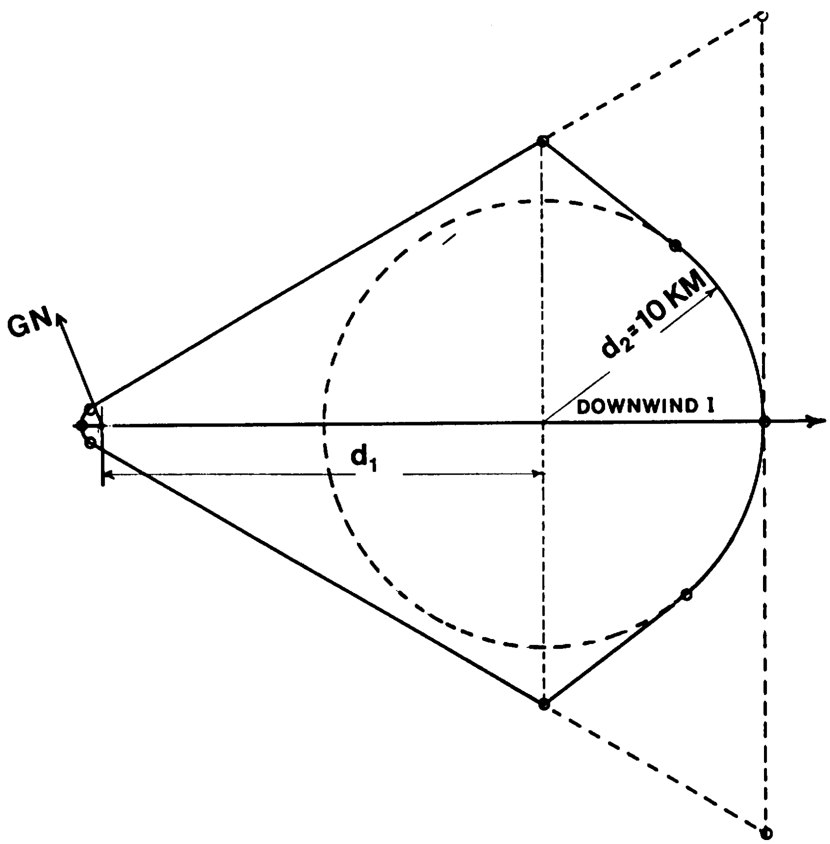


Figure 12-XI(c), Recalculation of Downwind Hazard Area.
Type "A" Attack, change in Wind Speed from > 10 KPH to ≤ 10 KPH.

(1) Calculate $\mathbf{d_1}$.
(2) From the centre of the original attack area measure the distance $\mathbf{d_1}$ along the downwind line and mark it.
(3) Using that point as the centre, draw a circle with a 10 km radius, until it intersects the two 30° tangents from the original plot. (See Figure 12 - XI(a)).
(4) If the circle does not intersect the tangent lines, draw a line at right angles to the downwind direction line at the $\mathbf{d_1}$ distance and mark

the intersections with the tangent lines. From these points draw two new tangents to the 10 km radius circle (See Figure 12-XI(c)).

g. Type "A" Case "2" Attack with a change in the Downwind Direction. <u>(NOT TO SCALE)</u>

Example NBC CDM
AREAM/NFEB43//
ZULUM/280600ZAPR1999/280900ZAPR1999/
281500Z APR1999//
UNITM/KM/DGT/KPH/C//
WHISKEYM/090/012/2/06/-/-/2//
XRAYM/090/014/2/08/-/-/2//
YANKEEM/140/015/2/08/-/-/2//

Example NBC 2 CHEM
ALFA/UK/A234/010/C//
DELTA/281245ZAPR1999//
FOXTROT/32UNG885419/EE//
GOLF/OBS/MLR/-/RKT/6//
INDIA/SURF/NERV/NP//
TANGO/FLAT/SCRUB//
YANKEE/090DGT/014KPH//
ZULU/2/08C/-/-/2//
GENTEXT/NBCINFO/
CONFIRMED BY DETECTOR KIT. RECALCULATION BASED ON CHANGE IN WIND DIRECTION AS OF 281300Z//

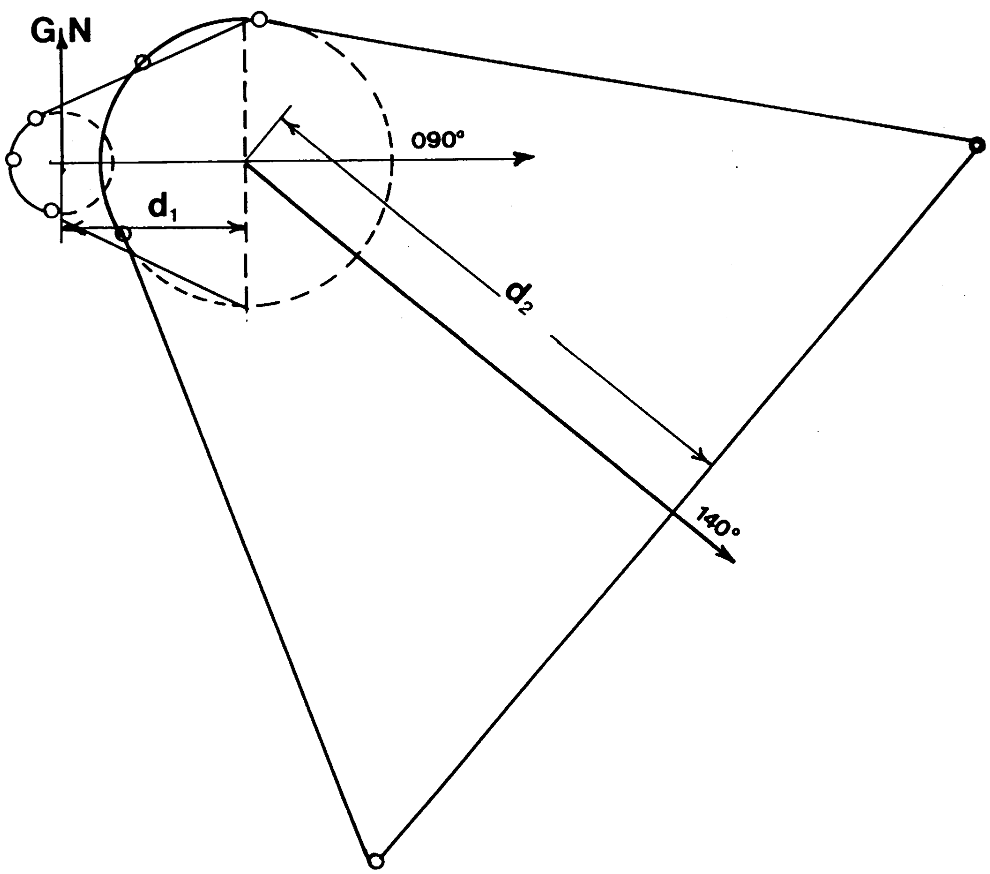


Figure 12-XII, Recalculation of Downwind Hazard Area.
Type "A", Case "2" Attack, change in Downwind Direction by 30 degrees or more.

(1) Calculate $\mathbf{d_1}$.
(2) From the centre of the original attack measure the distance $\mathbf{d_1}$ on the downwind line before the change in direction, and mark it.
(3) Draw a line at right angles to the downwind line through the point $\mathbf{d_1}$ until it meets the 30 degrees lines from the original plot.
(4) Using the $\mathbf{d_1}$ point as the centre, draw a new circle, the radius being the distance from the $\mathbf{d_1}$ point to one of the 30° tangents. The area within this circle is considered to be the new attack area.
(5) From the centre of this circle draw a line representing the "new" downwind direction.
(6) From the centre of this circle measure and mark the $\mathbf{d_2}$ distance on the new downwind direction line. If this distance falls within the circle then move it to the perimeter of the circle on the new downwind direction line. This will take into account the fact that some of the chemical cloud may travel at 1.5 times the mean wind speed, and will therefore have travelled further.
(7) Complete the plot by following the procedures in para 12134.e.(6) to 12134.e.(9).

h. Type "A" Case "2" Attack with a change in Stability Category or Downwind Speed. (NOT TO SCALE)

Example NBC CDM
AREAM/NFEB34//
ZULUM/280600ZAPR1999/280900ZAPR1999/281500ZAPR1999//
UNITM/KM/DGT/KPH/C//
WHISKEYM/110/015/6/10/-/4/2//
XRAYM/110/015/6/10/-/4/2//
YANKEEM/110/025/4/10/-/4/2//

Example NBC 2 CHEM
ALFA/UK/A234/012/C//
DELTA/281230ZAPR1999//
FOXTROT/32UPF730750/EE//
GOLF/OBS/AIR/6/BOM/18//
INDIA/SURF/NERV/NP//
TANGO/FLAT/SCRUB//
YANKEE/110DGT/015KPH//
ZULU/6/10C/-/4/2//
GENTEXT/NBCINFO/
RECALCULATION
BASED ON CHANGE IN
STABILITY CATEGORY
AS OF 281300Z//

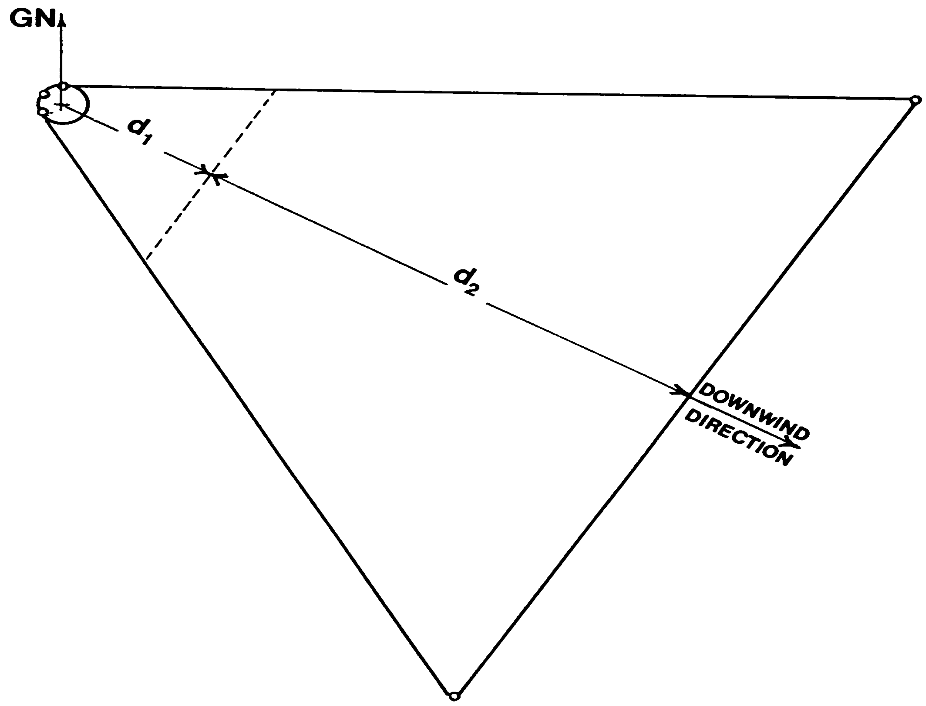


Figure 12-XIII, Recalculation of Downwind Hazard Area. Type "A", Case "2" Attack. Change in Stability Category and/or Downwind Speed.

From the centre of the original attack location plot the hazard area as described in para 1211.b., using $\mathbf{H_2}$ as the maximum downwind distance.

i. Type "B" Attack, Cases "2" and "4" with a change in Downwind Direction.

(1) From the centre of the original attack location, draw the new downwind direction line.

(2) Plot the new hazard area as described in paras 1212.b. and d., or reposition the template along the new downwind direction line and replot.
The total area covered by the old **and** the new hazard areas must be considered dangerous until confirmation of the absence of a chemical hazard in the "old" area is received.

j. **Type "B" Attack, Case "6"., with a change in Downwind Direction. (NOT TO SCALE)**

Example NBC 2 CHEM
ALFA/UK/A234/004/C//
DELTA/281000ZAPR1999//
FOXTROT/32VMH747388/EE//
GOLF/OBS/AIR/-/SPR/-//
INDIA/AIR/NERV/P//
TANGO/FLAT/SCRUB//
YANKEE/090DGT/020KPH//
ZULU/4/18C/8/-/0//
GENTEXT/NBCINFO/SYMPTOMS OF NERVE AGENT POISONING//

Example NBC CDM
AREAM/NFEA12//
ZULUM/280600ZAPR1999/280900ZAPR1999/
281500ZAPR1999//
UNITM/KM/DGT/KPH/C//
WHISKEYM/090/020/4/18/8/-/0//
XRAYM/150/020/4/18/8/-/0//
YANKEEM/150/020/4/18/8/-/0//

Example NBC 3 CHEM
ALFA/UK/A234/004/C//
DELTA/281000ZAPR1999//
FOXTROT/32VMH747388/EE/
32VMH897388/EE//
INDIA/AIR/NERV/P//
PAPAA/01KM/96HR/10KM/48HR//
PAPAX/281100ZAPR1999/
32VMH846318/32VMH846329/
32VMH856335/32VMH846341/
32VMH847456/32VMH742396/
32VMH740395/32VMH739394/
32VMH738393/32VMH738392/
32VMH737391/32VMH737389/
32VMH737388/32VMH736266/
32VMH836324/32VMH846318//
YANKEE/090DGT/020KPH//
ZULU/4/18C/8/-/0//
GENTEXT/NBCINFO/
RECALCULATION BASED ON NBC CDM WEATHER CHANGE AS OF 281100Z//

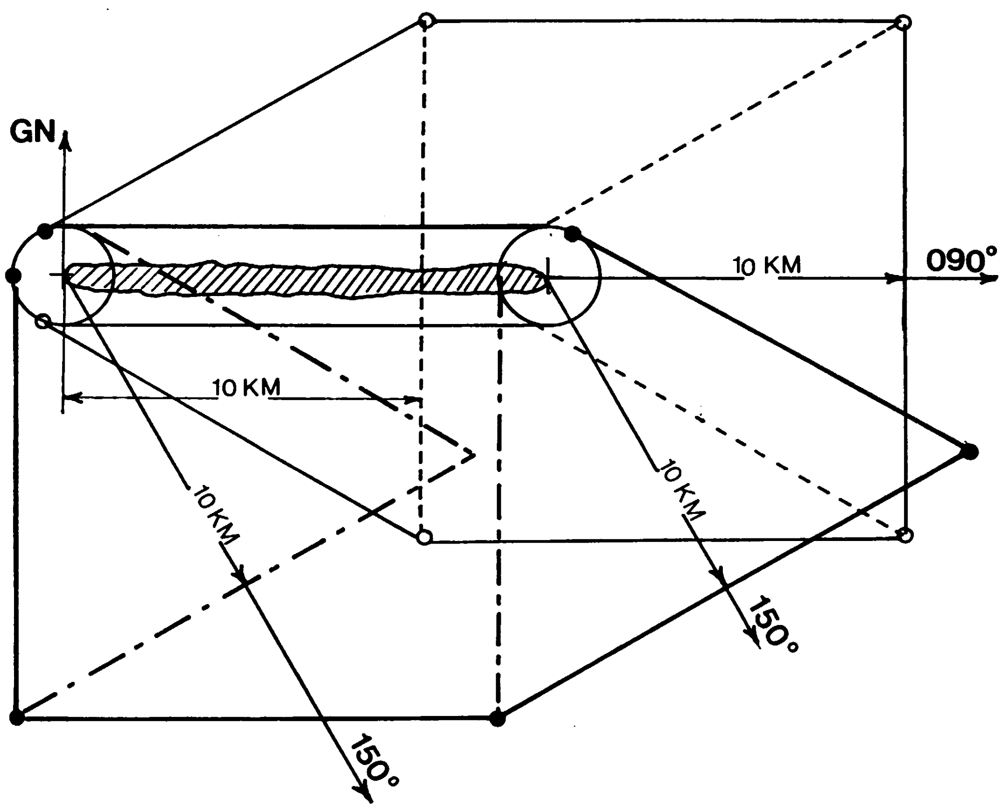


Figure 12-XIV, Recalculation of Downwind Hazard Area.
Type "B", Case "6" Attack, change in Downwind Direction.

(1) Plot the hazard area as calculated both for before and after the change in wind direction using the procedure described in para 1212.f.

(2) In the NBC 3 CHEM indicate in set GENTEXT/NBCINFO the reason for recalculation and the effective time for the new hazard area.

k. Type "B" Attack, Case 2, 4 and 6 with a change in Wind Speed from > 10 KPH to ≤ 10 KPH.

(1) Plot the hazard area as calculated for the wind speed > 10 KPH using the procedure described in para 1212.b., d. or f.

(2) Plot the hazard area as calculated for the wind speed ≤ 10 KPH using the procedure described in para 1212.a., c. or e.

l. In the examples of the hazard area, which is valid after the change in wind direction, also includes the area before the change. This takes into account transient hazards caused by the shift in wind direction in the areas between the two hazards.

m. When recalculation is completed, calculate the arrival time of the hazard, and issue a NBC 3 CHEM to those who will be affected. Issue the new NBC 3 CHEM to those units initially warned, to inform them that there may be a residual vapour hazard in their area. The same Strike Serial Number should be used as in the previous message and the previous message should be referred to in set GENTEXT/NBCINFO of the new message.

1215. Summary Table

CHANGES OF:	**A 1**	**A 2**	**B 1**	**B 2**	**B 3**	**B 4**	**B 5**	**B 6**
Wind Speed: By 10 KPH or more		X						
From > 10 KPH to ≤ 10 KPH		X		X		X		X
From ≤ 10 KPH to > 10 KPH	X		X		X		X	
Wind Direction: By 30 DEG or more		X		X		X		X
Stability Category:		X						

Type of agent container	Distance from centre of attack area along downwind axis, when stability condition is:		
	U	**N**	**S**
Shell, Bomblets and Mines. (SHL, BML, MNE)	10 KM	30 KM	50 KM
Air burst Missiles, Bombs, Rockets and Unknown Munitions. (MSL, BOM, RKT, UNK)	15 KM	30 KM	50 KM

Table 12-I, Type "A" Case "2" Attack Downwind Distance of Hazard Area.

Daily mean surface air temperature	Within attack area (number of days)	Within hazard area (number of days)
< 0° - 10° C	3 to 10 days	2 to 6 days
11° - 20° C	2 to 4 days	1 to 2 days
> 20° C	up to 2 days	up to 1 day

Table 12-II, Type "B" Attack, probable Time after Ground Contamination at which Personnel may safely remove Masks or Respirators.

Notes:

1. The estimates assume ground contamination densities up to 10 g/m^2.

2. In making hazard estimates, vapour has been considered to be the determining factor within the attack area as well as in the downwind hazard area. The duration of hazard from contact with bare skin is, however, difficult to predict. The duration can only be determined by the use of chemical agent detection or confirmation devices.

3. When temperatures are considerably lower than 0 degrees C, the duration of contamination may be longer than indicated in the table. The absence of vapour does not preclude the presence of contamination.

4. Daily mean surface air temperature may be obtained from local MET sources.

SECTION III - CALCULATION OF THE REMAINING HAZARD AREA

1216. Report Formatting Instructions at the NBC Centre.

1. In rare cases where a unit is hit by a downwind hazard without being able to identify the attack data needed to report a NBC 1 CHEM, the unit may report the measured data by use of a NBC 4 CHEM. Until detailed procedures are developed for such an off target situation, the responsible NBC Centre has to decide the actual course of action, including estimation of the hazard area and the need for warning.

2. Selected units in the contaminated area will be directed to submit additional NBC 4 CHEM reports. The NBC Centre uses these reports to evaluate a chemical contamination. For the format used to pass monitoring and survey results see the NBC 4 CHEM report as described in Chapter 2, para 206.

3. Monitoring reports contain the type of agent detected (set INDIA) indicating type of chemical agent and persistency, the location of the sampling (geographical position) and type of sample (air sample, liquid sample or SICA sample) (set QUEBEC), the date-time of the detection (set SIERRA), and topography information (set TANGO).

Example NBC 4 CHEM
INDIA/-/NERV/P//
QUEBEC/32VNJ481203/AIR//
ROMEO/5MM3//
SIERRA/071600ZFEB1999//
TANGO/FLAT/BARE//

4. If no chemical agent is detected, this should be reported by entering NIL into set INDIA. When all hazards from one attack are gone, the responsible NBC Centre should report this in a NBC 4 CHEM by entering NIL into set INDIA, and by entering "CHEMICAL FREE ATTACK" into set GENTEXT/NBCINFO. To be able to identify the attack, the strike serial number (set ALFA from the NBC 2) must be included into the report.

1217. Plotting Data and Producing a NBC 5 CHEM Message

1. Contaminated areas are shown on the Chemical situation maps, produced in the NBC Centres as a result of NBC 4 CHEM messages. This information must be passed to other units and HQ’s. The most expeditious means for this is the chemical contamination overlay. However, facsimile channels of electrical communications are not always available. If this is the case, the chemical contamination overlay must be converted into a series of coordinates for transmission as a NBC 5 CHEM report as in the following example:

Example NBC 5 CHEM
ALFA/BE/1BDE/002/C//
DELTA/071530ZFEB1999//

INDIA/AIR/NERV/P//
OSCAR/071930ZFEB1999//
XRAYA/-/32VNJ575203/32VNJ572200/32VNJ560219/
32VNJ548218/32VNJ540212/32VNJ537206/
32VNJ537193/32VNJ540187/32VNJ548181/
32VNJ560180/32VNJ572188/32VNJ575196/
32VNJ575203//

CHAPTER 13

DETERMINATION OF THE LIKELY HAZARD AREA FOLLOWING A CHEMICAL ATTACK, AND THE WARNING OF UNITS WITHIN THE AREA (SEA).

SECTION I - GENERAL INFORMATION

1301. Aim

1. The chemical prediction procedure for sea areas provides information on the location and the extend of the hazard area and the duration of the hazard resulting from attacks with chemical agents at sea and in the coastal region. It provides information necessary for commanders to warn units at sea and on the adjacent land areas.

1302. Definitions

1. **Attack Area**. The attack area is the predicted area immediately affected by the delivered chemical agents at sea or on the shoreline. If the location of the attack area is unknown, it is assumed to be located up wind, at a distance equivalent to the unit's maximum range of reconnaissance. The size of the attack area is assumed to be contained within a 0.5 NM radius circle.

2. **Hazard Area**. The hazard area is the predicted area in which unprotected personnel may be impaired in completing their mission by vapour spreading downwind from the attack area. The downwind hazard distance depends strongly on the defined hazard.

3. **Defined Levels of Hazard**. In this publication 3 (three) different levels of hazard may be taken into account:

- **LCt_{50}, ICt_5**, and **miosis**.

The following dosage limits (mg x min/m3) are valid:

Agent	LCt_{50}	ICt_5	Miosis
SARIN	70	5	3
SOMAN	70	5	3

<u>When preparing a NBC 3 CHEM message for the above listed chemical agents, the NBC agency must always indicate which hazard level the predicted hazard area is based upon</u>. This information should be contained in set GENTEXT.

1303. General Procedure

1. **The Horizontal Extent of the Downwind Hazard Area**. The horizontal extent of the downwind hazard area depends on:
   - The type of chemical agent.
   - The means of delivery (agent concentration in the attack area).
   - The meteorological conditions.
   - The defined hazard (hazard level).

2. **The Vertical Extent of the Hazard**. The hazard extends at least up to 150 m above the sea surface in the vertical. Aircrews flying low level must therefore be warned accordingly.

3. **Chemical Attacks**. Chemical attacks may basically be divided into:
   - Air-contaminating Attacks (Type A attacks), (non-persistent agents), and
   - ground contaminating attacks (Type B attacks), (persistent agents).

   a. Air-contaminating Attacks (Type A attack). In this document, for prediction purposes, two types of air contaminating (non-persistent) agents are recognised:
      - Sarin (GB) and all other known non persistent agents, and
      - Soman (GD) as an aerosol.

      If the agent can not be identified, use GB.

   b. Ground-contaminating Attacks (Type B attacks), (persistent agents): Large quantities of persistent chemical agents may be released with the intention of contaminating ship surfaces. For such a situation the procedures in Chapter 12 should be used. However at sea, the resulting hazard area will be over predicted since persistent agent(s) hydrolyse and mix with water and will not generate as much vapour from evaporation as results from land contamination.

4. **Means of Delivery**. The delivery means are listed in annex C, C04.a. In cases where the means of delivery is unknown, MLR is assumed.

5. **Meteorological Data**. The meteorological data required for the downwind hazard area prediction procedure is provided in a NBC Chemical Downwind Message (NBC CDM) (see chapter 12).
Valuable MET information can be provided by the attacked unit itself. Therefore units at sea reporting a chemical attack should always attempt to include actual weather information under set YANKEE and ZULU in NBC 1 CHEM or NBC 2 CHEM reports. ZULU may be encoded or in plain text.

6. **Inversion Layers**. In most cases the concentration of the chemical agent will decrease with increasing height and reach a low concentration (miosis level) at approximately 800 metres. Normally there will be no risk above 3000 metres. Certain

meteorological conditions in the atmosphere, known as Inversion Layers, are associated with stable conditions specified in the NBC CDM/NBC CDF under the term "stability category". Stable conditions usually occur at night or in the morning under conditions of clear skies and low wind speed but will also result any time the ground or water surface is cooler than the air above it. An Elevated Inversion layer occurs when the surface inversion layer decays or under unusual advection conditions. With both inversion and elevated inversion layers the concentration of the chemical agent will be higher within the layer than with no inversion. The concentration of the chemical agent will be very small above the layer. If the height of the top of any inversion layer is lower than 800 metres, this will be indicated in the NBC CDM/NBC CDF by the letter "A" appearing in the coded "significant weather phenomena". If the height of the top is lower than 400 metres, letter "B" is to be used, if lower than 200 metres, letter is to be "C". These letters signify the safe altitudes for aircraft to avoid being chemically contaminated.

7. **Prediction Procedures**. For sea areas, the prediction of chemical downwind hazard areas follows either

- The simplified procedure (see Section II)

  or
- The detailed procedure (see Section III).

The simplified procedure is intended for use in ships, whereas the detailed procedure is designed for use in NBC agencies at Naval HQ’s, where trained NBC personnel and suitable facilities are available.

SECTION II - THE SIMPLIFIED PROCEDURE

1304. The Simplified Procedure, Requirements

1. The simplified procedure requires:
   - Sea chart of the area of operation,
   - Ship's Chemical Template (Figure 13-I),
   - NBC 1 CHEM or NBC 2 CHEM, and
   - NBC CDM.

2. If a valid NBC CDM is not available, Annex E, Figure E-I may be used to determine the air stability category, which is the basis for the determination of the maximum downwind hazard distance.

3. This distance is determined from Annex E, tables III and IV. <u>When using the simplified procedure, use the downwind hazard distances related to miosis</u>.

4. The downwind direction and downwind speed must be determined on board.

1305. Determination of the Hazard Area

1. The hazard area is determined as follows:

a. The centre of the attack area (NBC 1 CHEM or NBC 2 CHEM, set FOXTROT) is plotted on the chart.
A circle, the radius of which is 0.5 NM is drawn around the centre. This circle represents the attack area.(Figure 13-II).

b. The template for a simplified chemical hazard area prediction is placed on the chart in such a way that the centre point of the template circle coincides with the centre of the attack area. The value on the protractor corresponding to the downwind direction given in the NBC CDM must be oriented towards the north on the chart. This position of the template is marked on the chart by using the holes punched in the template along the downwind axis.
The template is then moved back along the downwind axis until the radial lines become tangents to the circle (30 degrees standard).
Use the holes punched out along the radial lines to mark the position and connect to the circle, forming tangents.

c. The maximum downwind hazard distance is then marked on the downwind axis. Through this point a line is drawn perpendicular to the downwind axis, to intersect the tangents. (Figure 13 - II).

d. When, in the NBC CDM, light winds are reported (wind speeds of 5 knots or less), the hazard area is represented by a circle concentric to the attack area, with a radius equal to 15 NM.

SECTION III - THE DETAILED PROCEDURE

1306. The Detailed Procedure, Requirements

1. The detailed procedure is based upon the information compiled in the "**C**hemical **P**rediction **D**ata **S**heet" (CPDS) and NBC 1 CHEM or NBC 2 CHEM.
The CPDS (See Annex E, Figure E-II) must be filled in immediately on receipt of a new and updated NBC CDM, and checked on the receipt of a NBC 1 CHEM or NBC 2 CHEM, containing meteorological information in set YANKEE and ZULU.

2. The delineation of the hazard area resulting from an attack with chemical agents requires information on:

a. The chemical agent and means of delivery.

b. Location of the attack area as reported in NBC 1 CHEM or NBC 2 CHEM.

c. Downwind direction of the agent cloud (taken from CPDS).

d. Maximum downwind hazard distance(s) related to the appropriate hazard level(s) (LCt_{50} and/or ICt_5 and/or miosis). (Taken from CPDS).

e. Half-sector angle of the hazard area:

- 35 degrees for wind speeds higher than 5 knots, but less than 10 knots,
- 20 degrees for wind speeds of 10 knots and more.

For wind speeds equal to 5 knots or less, the hazard area will be circular with radius equal to the downwind hazard distance for 5 knots wind speed. However, the radius should not exceed 15 NM.

1307. Determination of the Downwind Hazard Area

1. To plot the chemical downwind hazard area on a sea chart or on General Operations Plot, the above information is used in the following way: (See Figure 13-III).

a. Plot the location of the attack area.
If the exact location (centre of the attack) is known, draw a circle around this point with a radius of 0.5 NM.
If only a dissemination area is reported, determine the centre point of this area and draw a circle around this point, using a radius of 0.5 NM.
If the size of the attack area is known to be larger, the radius must be adjusted accordingly.

b. From the centre of the attack area circle draw a line, representing the downwind direction.

c. Draw two lines which, being tangents to the circle, form an angle equal to the half sector angle on either side of the downwind direction (downwind axis).

d. Label the point on the downwind direction line (downwind axis), thus marking the extend of the downwind hazard distance(s) for the relevant level(s) of hazard (LCt50 and/or ICt5 and/or miosis) and draw a line through this (these) point(s), perpendicular to the downwind axis and intersecting the two tangents.
The downwind hazard area(s) is (are) contained within this (these) line(s), the tangents and the upwind arc of the attack area circle.

2. When low wind speeds are reported in the NBC CDM, (wind speed 5 knots or less), draw a circle concentric to the attack area circle, using the relevant downwind hazard distance as the radius. However, the radius should not exceed 15 NM (see Figure 13 - IV).

1308. Change in Meteorological Conditions

1. If the meteorological conditions change within the period of duration of the hazard, the predicted hazard area must be adjusted only if:

   a. The stability category changes from one category to another, and/or

   b. The wind speed changes by more than 5 knots or from 5 knots or less to more than 5 knots and vice versa, or

   c. The wind direction changes by more than 20 degrees.

2. The hazard area is then determined as follows: Calculate the downwind distance which the agent cloud may have travelled at the time the change in the meteorological conditions occurred, by using the downwind speed. Consider this point to be the centre point of a "new" attack area, and draw a circle around it with a radius equal to half the width of the hazard area at that point. From there on, repeat the steps beginning with the procedure prescribed in para 1307.a.(2). The distance, which the agent cloud may already have travelled, must be subtracted from the maximum downwind hazard distance under the new weather conditions. (Figure 13-V).

3. Agent Clouds crossing the Coast Line. When a cloud from a chemical agent crosses the coast line from sea to land or vice versa, consider the point where the downwind direction line (downwind axis) intersects the coast line to be the centre point of a "new" attack area, and follow the procedure described in para 1308.b. above, using the appropriate tables for sea and land to determine the downwind hazard distances. **When frequent changes occur, use the land procedure when working manually**. (Chapter 12).

4. In the case of air contaminating attacks, the beginning and the end of the hazard at a given point may be determined from:

   a. The downwind speed.

   b. The distance of the location from the edge of the attack area.

   c. The beginning and the end of the attack.

The following two formulas are used:

$$t_B = (d_A \times 60) / (1.5 \times V_Z) \text{ or}$$
$$t_B = (d_A \times 40) / V_Z \text{ and}$$

$$t_E = (d_B \times 60) / (0.5 \times V_Z) \text{ or}$$
$$t_E = (d_B \times 120) / V_Z = 3 \times t_B$$

t_B = time in minutes from the beginning of the attack to the beginning of the hazard.

$\mathbf{d_A}$ = distance between the location and the downwind leading edge of the dissemination area (in NM).

$\mathbf{d_B}$ = distance between the location and the downwind trailing edge of the dissemination area (in NM).

$\mathbf{V_Z}$ = wind speed in knots. If necessary, the wind speed must be determined as the mean wind speed over several periods of validity of the NBC CDM.

$\mathbf{t_E}$ = time in minutes from the end of the attack to the end of the hazard.

EXAMPLE:

Given: $\mathbf{d_A}$ = 5 NM, $\mathbf{V_Z}$ = 10 knots.

Using the formulas,

$\mathbf{t_B}$ and $\mathbf{t_E}$ are calculated as follows:

$\mathbf{t_B}$ = (5 NM x 40) / 10 knots = 20 minutes, and

$\mathbf{t_E}$ = (5 NM x 120) / 10 knots = 60 minutes

5. The expected maximum duration of the air-contaminating hazard (i.e.; when the calculated hazard is expected to be completely clear), may be obtained by using the maximum downwind hazard distance as $\mathbf{d_A}$, and calculating $\mathbf{t_E}$ from the formulas in para d. above.

6. The NBC agency (NBC Collection Centre/NBC Sub Collection Centre) must continuously check the NBC 3 CHEM messages issued, in order to ensure that any new information (meteorological or NBC) is considered. If necessary, a corrected NBC 3 CHEM message must be transmitted.

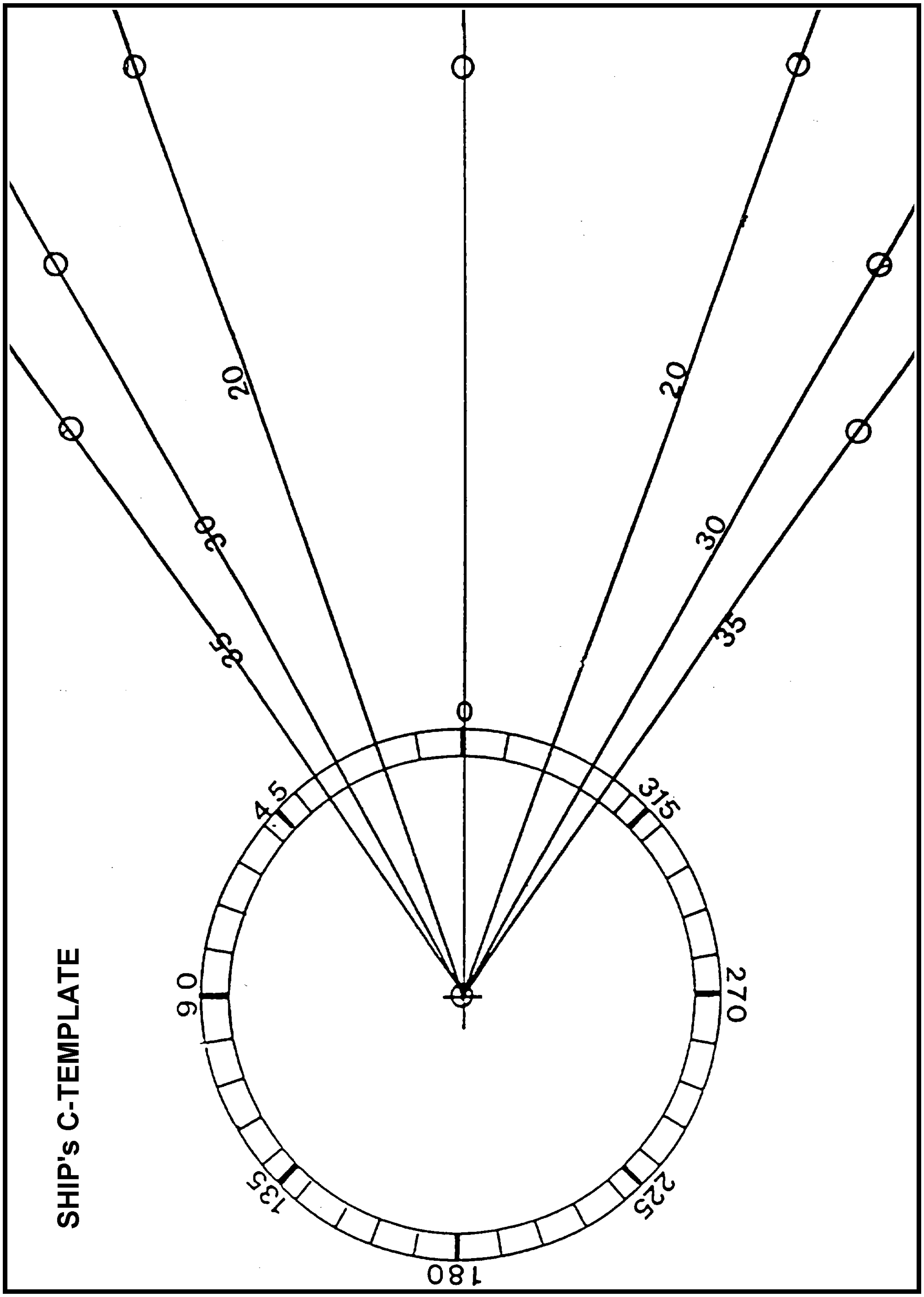


Figure 13-I, Ship's Chemical Template (example).
Note: The production of the Chemical Template is a national responsibility.

Figure 13-II, Chemical Downwind Hazard Area Plot (Simplified Procedures)

NBC 1 CHEM

NBCEVENT/CHEM//
ALFA/GE/TU3001/003/C//
BRAVO/411148N0092348E/-//
DELTA/250915ZAUG1999/250920ZAUG1999//
FOXTROT/411148N0092348E/AA//
GOLF/OBS/MRL/-/RKT/8//
INDIA/SURF/NERV/P//
TANGO/SEA/-//

NBC 2 CHEM

NBCEVENT/CHEM//
ALFA/GE/TG300/003/C//
DELTA/250915ZAUG1999/250920ZAUG1999//
FOXTROT/411148N0092348E/AA//
GOLF/OBS/MRL/-/RKT/8//
INDIA/SURF/NERV/P//
TANGO/SEA/-//
YANKEE/030DGT/058KPH//
ZULU/5/25C/-/-/0//

NBC 1 CHEM

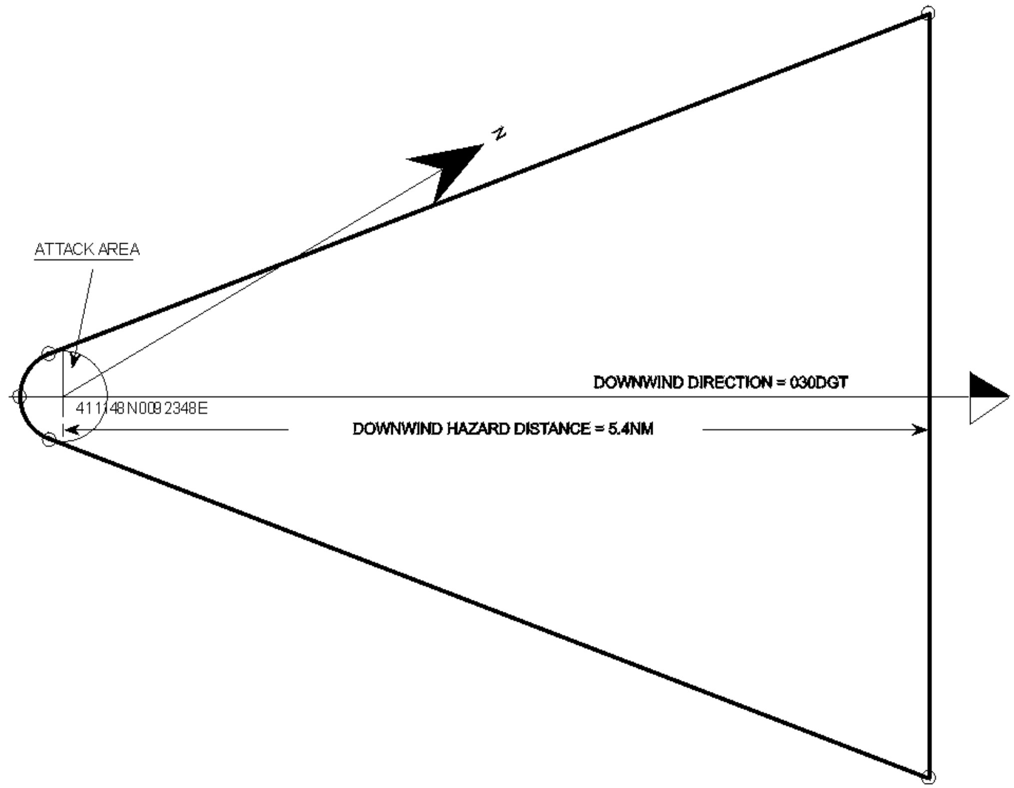
NBCEVENT/CHEM//
ALFA/GE/TU3002/005//C//
BRAVO/411106N0092348E/359DGG//
DELTA/250916ZAUG1999//
INDIA/SURF//
TANGO/SEA/-//

NBC 1 CHEM

NBCEVENT/CHEM//
ALFA/GE/TU3002/001/C//
BRAVO/411230N0092206E/118DGG//
DELTA/250915ZAUG1999//
INDIA/SURF//
TANGO/SEA/-//

NBC CDM

AREAM/NBWC//
ZULUM/250830ZAUG1999/250900ZAUG1999/251500ZAUG1999//
UNITM/-/DGT/KTS/C//
WHISKEYM/030/030/5/25/5/-/0//
XRAYM/025/035/5/25/5/-/0//
YANKEEM/020/040/5/24/5/-/0//



NBC CDM

NBCEVENT/CDM//
AREAM/NFEB4//
ZULUM/160530ZJUL1999/160600ZJUL1999/161200ZJUL1999//
UNITM/-/DGT/KTS/C//
WHISKEYM/160/025/3/22/5/-/0//
XRAYM/160/030/2/21/5/-/0//
YANKEEM/160/025/3/20/5/-/0//

NBC 2 CHEM

NBCEVENT/CHEM//
ALFA/DA/TG300/005/C//
DELTA/160610ZJUL1999/160613ZJUL1999//
FOXTROT/554230N0104630E/AA//
GOLF/OBS/BOM/2/-/-//
INDIA/SURF/GB/NP//
TANGO/SEA/-//

NBC 3 CHEM

NBCEVENT/CHEM//
ALFA/DA/TG300/005/C//
DELTA/160610ZJUL1999/160613ZJUL1999//
FOXTROT/554230N0104630E/AA//
GOLF/OBS/BOM/2/-/-//
INDIA/SURF/GB/NP//
PAPAA/1NM/-/2NM/-//
PAPAX/160600ZJUL1999/554234N0104444E/
554327N0104554E/
554308N0104752E/
554114N0105041E/
554001N0104444E//
GENTEXT/NBCINFO/THIS NBC 3 HAS BEEN CALCULATED FOR THE ICT5 LEVEL//

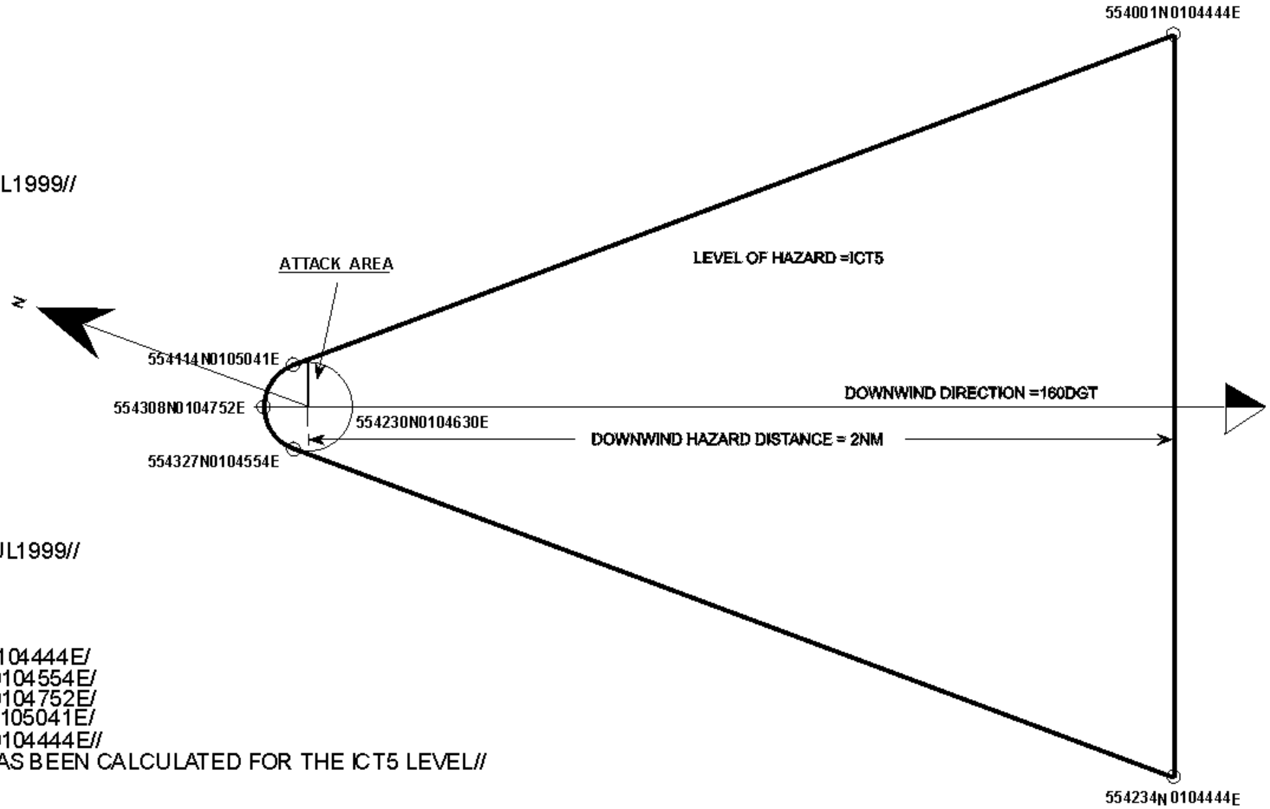


Figure 13-II, Downwind Hazard Area, Type "A" Attack, Wind Speed 10 knots or more.

NBC CDM

AREAM/NFEB3//
ZULUM/150530ZJUN1999/150600ZJUN1999/151200ZJUN1999//
UNITM/-/DGT/KTS/C//
WHISKEYM/070/005/3/20/5/-/0//
XRAYM/075/005/3/20/5/-/0//
YANKEEM/070/005/3/20/5/-/0//

NBC 2 CHEM

NBCEVENT/CHEM//
ALFA/GE/TG301/011/C//
DELTA/150655ZJUN1999/150656ZJUN1999//
FOXTROT/541000N0113000E/AA//
GOLF/OBS/AIR/2/BOM/6//
INDIA/SURF/GB/NP//
TANGO/SEA/-//
YANKEE/070DGT/010KPH//
ZULU/3/20C/-/-/0//

NBC 3 CHEM

NBCEVENT/CHEM//
ALFA/GE/TG301/011/C//
DELTA/150655ZJUN1999//
FOXTROT/541000N0113000E/AA//
INDIA/SURF/GB/NP//
PAPAA/01NM/-/008NM/-//
PAPAX/150600ZJUN1999//
YANKEE/070DGT/010KPH//
ZULU/3/20C/-/-/0//
GENTEXT/NBCINFO/LEVEL OF HAZARD MIOSIS//

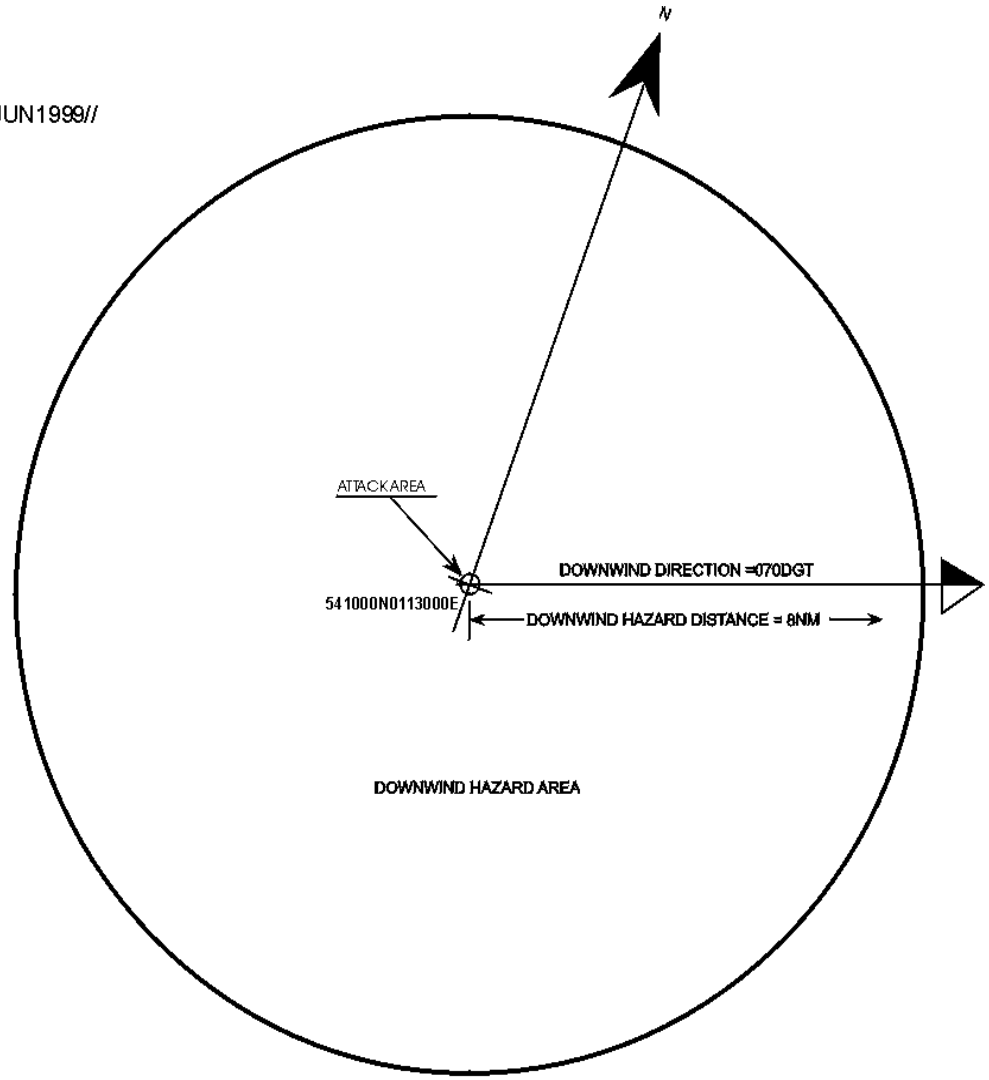


Figure 13-IV, Downwind Hazard Area, Type "A" Attack, Wind Speed 5 knots or less or variable.

NBC CDM

AREAM/NFEB4//
ZULUM/250830ZOCT1999/250900ZOCT1999/251500ZOCT1999//
UNITM/-/DGT/KTS/C//
WHISKEYM/040/010/4/12/7/5/2//
XRAYM/090/009/4/14/7/5/2//
YANKEEM/120/008/4/15/7/5/2//

NBC 2 CHEM

NBCEVENT/CHEM//
ALFA/IT/TG402/002/C//
DELTA/251215ZOCT1999//
FOXTROT/554100N0103500E/AA//
GOLF/OBS/AIR/3/BOM/6//
INDIA//SURF/GB/NP//
TANGO/SEA/-//
YANKEE/090DGT/018KPH//
ZULU/4/14C/-/-/2//

NBC 3 CHEM

NBCEVENT/CHEM//
ALFA/IT/TG402/002/C//
DELTA/251215ZOCT1999//
FOXTROT/554100N0103500E/AA//
INDIA/SURF/GB/NP//
PAPAA/6.75NM/-/16NM/-//
PAPAX/-/554100N0103406E/
554124N0103430E/
554306N0103942E/
554518N0104624E/
554518N0110936E/
552724N0105136E/
553854N0103942E/
554036N0103430E//
YANKEE/090DGT/009KTS//
ZULU/4/14C/7/5/2//
GENTEXT/NBCINFO/LEVEL OF HAZARD ICT5//

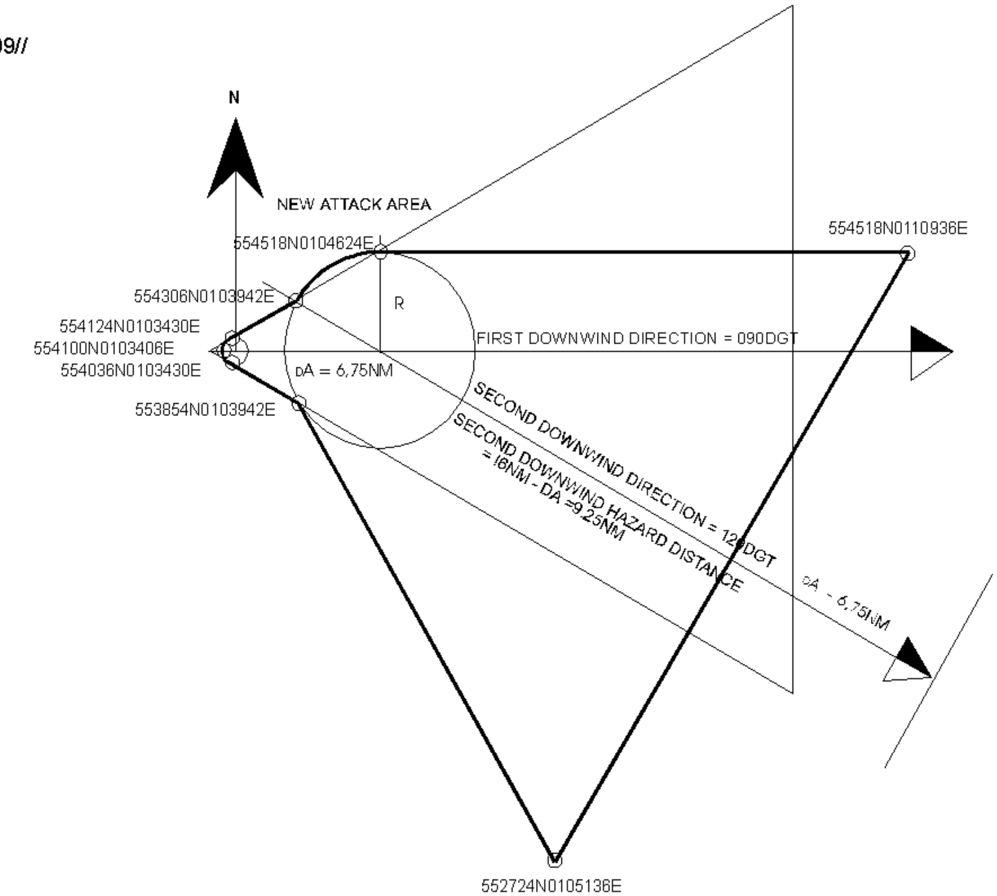


Figure 13-V, Recalculation of Downwind Hazard Area, Type "A" Attack, after Change in Downwind Direction at Point B.

CHAPTER 14

DETERMINATION OF THE LIKELY HAZARD AREA FROM ROTA

1401. Aim

1. This chapter covers the manual procedures to warn and report NBC releases other than the "traditional" military NBC attacks resulting from offensive use of NBC weapons. These releases, referred to as Releases Other Than Attack (ROTA), may include, but are not limited to, NBC releases due to damaged or destroyed storage bunkers, transport vehicles, storage or production facilities, ammunition supply sites, power plants, etc.

1402. Definitions

1. **RELEASE AREA.** This is the predicted area immediately affected by the release.

2. **HAZARD AREA.** This is the predicted area in which unprotected personnel may be affected by NBC material spreading downwind from the **RELEASE AREA.** The downwind distance depends on the type of release and the weather and terrain in both the **RELEASE AREA** and the area downwind of the **RELEASE AREA.**

3. **CONTAMINATED AREA.** This is the area in which NBC material may, in solid or liquid form, remain at hazardous levels for some time after the release. The actual shape and duration can only be determined by surveys.

4. **ELEVATED RELEASES.** Any release which, due to fire, momentum, or explosion, is carried above 50 m above the ground is considered an elevated release.

5. **TOXIC INDUSTRIAL MATERIALS (TIM).** A generic term for toxic or radioactive substances in solid, liquid, aerosolised or gaseous form. These may be used, or stored for use, for industrial, commercial, medical, military or domestic purposes. TIM may be chemical, biological or radioactive and may be described as Toxic Industrial Chemicals (TIC), Toxic Industrial Biologicals (TIB) or Toxic Industrial Radiologicals (TIR).

1403. General

1. The prediction of the attack and/or hazard area is dependent upon:
   - The type of release
   - The meteorological and other factors

1404. The Type of Release

1. Present in any area of operation there may be chemical, biological, and/or radiological material, which will present a hazard to persons if released into the atmosphere. Releases may be accidental or intentional. The amount of material

released may be small or extremely large. Such Releases Other Than Attack (ROTA), can be divided into 2 types based on their origin:

a. **Type N, ROTA NUCLEAR.** Nuclear material can be released into the atmosphere from the core of a nuclear reactor, which has been damaged or which has gone out of control. Similar incidents may occur at nuclear fuel reprocessing or production facilities. Such a release can result in very high levels of radiation covering distances of hundreds of km.

b. **Type T, TOXIC INDUSTRIAL MATERIALS.** There are five cases of incidents under Type TIM. These sub cases include items that may be used, or stored for use, for industrial, commercial, medical, military or domestic purposes. TIM may be chemical, biological or radioactive.

(1) **Case 1, NUCLEAR WASTE OR RADIOLOGICAL MATERIAL STORAGE.** Damage to a nuclear or radiological material storage facility may result in release of radiological material into the atmosphere. Such a release will result in low level radiation covering a fairly short distance of danger to anyone remaining in the hazard area for extended periods of time.

(2) **Case 2, RADIOLOGICAL DISPERSION.** Intentional release of large amounts or radiological material can result in hazard areas extending far downwind.

(3) **Case 3, BIOLOGICAL BUNKER OR PRODUCTION FACILITY.** Damage to a storage bunker containing biological agents intended for use in biological warfare or to production facilities for such agents containing active agent containers will result in smaller release areas and lower quantities than if they had been dispersed from a weapon. However, due to the toxicity of such agents, and the likelihood of having an elevated plume, dispersed material may travel downwind for many hours at hazardous levels.

(4) **Case 4, CHEMICAL STOCKPILE OR TIM TRANSPORT / STORAGE.** Damage to stockpiled munitions containing chemical agents will result in considerably smaller quantities of agent released than intentional use of the munitions, so the downwind hazard area will usually be smaller than for a chemical attack. Damage to containers of Toxic Industrial Material (TIM) being transported by road, rail, or boat can result in large quantities released into the atmosphere. However, the toxicity and stability of these materials will be less than for chemical agents, so hazard areas will also be smaller than for a chemical attack. This category also includes small storage quantities and single munitions found leaking on the battlefield.

(5) **Case 5, BULK CHEMICAL STORAGE.** Toxic industrial chemicals (TIC) are stored in very large (greater than 1500 kg) quantities in large tanks, often under pressure and/or at low temperatures. A catastrophic rupture of such a tank will result in a highly toxic cloud, which usually exhibits dense gas behaviour. This type of release may also occur intentionally by a terrorist or other deliberate action. Such a cloud will not travel with the wind until after its concentration has been reduced considerably, often when it is below toxic levels. In addition to their toxicity, industrial chemicals are often corrosive, flammable, explosive, or able to react violently with air or water. These hazards may be greater than the immediate toxic effects.

1405. Procedures and Constraints

a. **Procedures**

(1) Record and update the following information:

- Weather information from relevant NBC CDRs, which may contain both forecast data and measured data,
- Weather information from local measurements/observations, which may contain both data before and during the cloud passage period,
- A data base of local meteorology measured during the cloud passage period

(2) Record terrain features (wooded areas, mountains, plains, etc.) which may influence the direction and speed of ROTA release clouds.

(3) An NBC3 ROTA may be generated and considered for distribution whenever the threat of a ROTA event is high. If detection equipment is available this report will most likely be generated from one or more NBC1, 2 or 4 ROTA reports. Otherwise, this report will most likely be generated from one or more NBC1, 2 or 4 ROTA, where the released agent is unknown.

(4) On receipt of NBC 1 ROTA or NBC 2 ROTA, estimate the meteorological parameters for the release area and downwind of the release area.

(5) Select, in accordance with national directives, the weather information to be used and calculate the predicted downwind hazard area.

b. Constraints

(1) When calculating the predicted downwind hazard area from ROTA releases, many factors will affect the accuracy of the prediction. Some of these factors are:
- Type of and amount of chemical agents,
- Type of and amount of delivery or storage system(s),
- Type of and amount of agent container(s),
- Terrain composition,
- Weather (rain, clouds etc.),
- Air stability,
- Type of surface(s),
- Vegetation(s),
- Surface air temperature,
- Relative humidity

and changes to these factors.

(2) Some of these factors are not considered when using the procedures in this chapter, unless evaluated and estimated manually by the user.

(3) The procedure shown in this chapter is based on the limited amount of information available at the time of the event.

(4) To be able to make more accurate predictions, more information about the listed factors has to be available and more sophisticated methods have to be used for prediction. Such procedures are described in AEP-45, Appendices D-12, D-14 and D-20.

1406. ROTA Types and Cases

Type of release / material type	Sub category	Type	Case	Procedures
Nuclear Reactor		N		1407.a. (Chapter 9)
Toxic Industrial Material	Nuclear Waste	T	1	1407.b.(1)
	Radiological Dispersion		2	1407.b.(2) (Chapter 9)
	Biological Bunker		3	1407.b.(3) (Chapter 9)
	Chemical Stockpile / TIM Transport		4	1407.b.(4) (Chapter 12 or ERG)
	Bulk Chemical Storage		5	1407.b.(5)

1407. Hazard Prediction Methods

1. **Type N, Releases of Nuclear Fuel.** Material released from a nuclear reactor incident will be mostly or all particles of nuclear fuel. Since the decay of particles from a

nuclear reactor accident is different than for nuclear weapon fallout, the procedures used for hazard prediction after nuclear detonations, cannot be used.

The release may be violent enough to send the nuclear fuel particles into the upper atmosphere. The hazard area prediction procedures described in Chapter 9 should be used, assuming a Type ”P” attack. If the release takes more than 5 minutes, the latest arrival time may need to be adjusted for the duration of the release. Hazard areas for extended duration releases should be recalculated as a Type ”R” attack where the end points of the line are the release location and the current position of the front end of the cloud, using 1.5 times the mean wind speed. For wind speeds ≤ 10 KPH, Type “P” must be used.
If the release is reported as continuous and the reported duration exceeds 2 hours or is not reported, the procedures for Type “S” should be followed.
If the bulk of the material is elevated to high altitude, the wind speed and bearing at that height from the NBC BWR or other appropriate meteorological data should be used. If the material extends continuously from near the ground to high elevation (above 50 m), the procedures for an elevated release in para 1408, should also be used.

2. **Type T, Releases of Toxic Industrial Materials.** Due to the differences in materials and/or release types, hazard prediction methodology must be broken down into five sub cases. Each TIM sub case is described in para 1404.b.

a. **Case 1. Releases from Nuclear Waste or Radiological Material Storage Facilities.** Nuclear and radiological material is usually stored well below ground level, usually in special lead drums contained in concrete shelters. Damage to such a facility may rupture some of the drums and release the radiological material into the atmosphere over an extended period of time. The rate of expulsion will be a function of the mass of material released from the drums, the degree of radioactivity of the material, and the amount of energy added to the storage area. The release area will be very localised, and the hazard area is not expected to be very large. But, the cloud may be toxic at low levels for an extended period of time. An exclusion zone of 1 km radius around a suspected radiological hazard should be established.

b. **Case 2. Releases from Radiological Dispersion Devices.** If a high level of radiation is detected as a passing cloud, the release will likely have been intentional and involve large quantities of radiological material, which may continue at toxic levels for a considerable downwind distance. The cloud of radiological particles will be transported like a biological agent cloud, so the biological procedures from Chapter 9 for a Type "S" attack should be used. If the radiological release is observed, the corresponding biological attack type “P” or “R” should be used.

c. **Case 3. Releases from Biological Agent Bunkers or Production Facilities.** Storage facilities for biological agents usually consist of underground concrete shelters. These shelters are closer to the ground surface. Damage to such a facility may release some biological material

from the shelter into the atmosphere as a jet of biological agent, smoke, dust, and soil. The release area will be localised, and the amount of viable agent dispersed will likely be less than that dispersed from an efficient biological weapon. However, since many biological agents only require a few inhaled organisms to infect a person the downwind distance of the hazard area may still be considerable. The biological hazard area prediction procedures in Chapter 9 should be used for a Type "P" attack. If the release takes more than 5 minutes, the latest arrival time may need to be adjusted for the duration of the release. Hazard areas for extended duration releases should be recalculated as a Type "R" attack where the end points of the line are the release location and the current position of the front end of the cloud, using 1.5 times the mean wind speed. For wind speeds ≤ 10 KPH, Type “P” must be used.
If the release is reported as continuous and the reported duration exceeds 2 hours or is not reported, the procedures for Type “S” should be followed. If the bulk of the material is elevated to high altitude (above 50 m), the wind speed and bearing at that height from the NBC BWR or other appropriate meteorological data should be used. If the material extends continuously from near the ground to high elevation, the procedures for an elevated release in para 1408 should also be used.

d. **Case 4. Releases from a Chemical Stockpile or TIM Transport/ Storage.** Incidents involving release of chemical agents from a stockpile of munitions or bulk storage will usually involve only a small number of munitions. In such a case the downwind hazard will be considerably smaller than that predicted using the procedures in Chapter 12. In the case of chemical agent release from a large number of munitions or bulk storage of chemical agents, the agent quantity will be sufficient to warrant use of the Chapter 12 procedures. Because of their lower toxicity and stability, incidental release of Toxic Industrial Material from transport vehicles is expected to affect an area considerably smaller than that predicted using the chemical agent procedures.

The procedure to use is determined as follows:

- Chemical stockpile or bulk storage mass released exceeds 200 litres (LRG): Use the procedures in Chapter 12 for the appropriate agent and persistency.
- Chemical agent detection with no source observation: Use the reporting procedures in para 1409.
- Chemical stockpile mass released is SML, or
- Single leaking munition, or
- Toxic Industrial Material release from a transport vehicle: Use the following procedure adapted from the Emergency Response Guidebook (ERG).

(1) **RELEASE AREA.** The release area is assumed to be a circle having a radius equal to the ISOLATION distance from the ERG. The 4 digit UN/NA ID number is provided in Field 2

of INDIA. If the ID number or the ERG are not available, use a radius of 915 m. If the distance is not found in the green section of the ERG, the orange section should be consulted before using the default distance. If more information is available, a different radius may be specified in GENTEXT. Draw the circle of the specified radius centred at the release location.

(2) **PROTECTIVE ACTION DISTANCE.** Obtain the protective action distance from the ERG using the 4 digit UN/NA ID number and the size of the spill provided in field 5 of GOLF. If the size of the spill is not available, assume LRG. If the ID number is not available, use a distance of 11 km. If the distance is not found in the green section of the ERG, the orange section should be consulted before using the default distance. **If the spill is greater than 1500 kg (XLG),** double the PROTECTIVE ACTION DISTANCE.

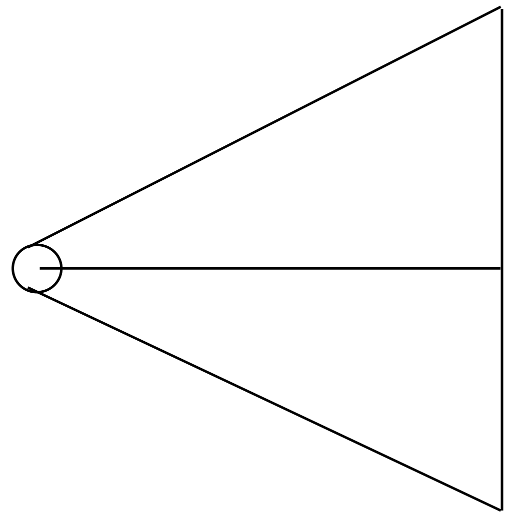
(3) **WIND SPEED** less than or equal to 10 KPH. The wind direction is then considered to be variable, so draw another circle of radius equal to the PROTECTIVE ACTION DISTANCE, also centred at the release location.

(4) **WIND SPEED** greater than 10 KPH. Draw a line in the downwind direction starting at the release location of length equal to the PROTECTIVE ACTION DISTANCE. (The remaining steps follow the drawing procedures from Chapter 12, rather than from ERG). Draw a line at the end of the downwind direction line perpendicular to the downwind direction. Extend the downwind direction line in the upwind direction a distance equal to twice the RELEASE AREA radius. Draw two lines from the upwind end of the downwind direction line to the perpendicular line at the other end which are tangent to the top and bottom of the RELEASE AREA circle. (See Figure 14-I).
If the bulk of the material is elevated to high altitude, the wind speed and bearing at that height from the NBC BWR or other appropriate meteorological data should be used. If the material extends continuously from near the ground to high elevation (above 50 m), the procedures for an elevated release in para 1408 should also be used.

(5) **LIMITATIONS.** The initial hazard area is considered valid until additional information is available. When significant changes in weather conditions occur (see para 1214.a-c), a recalculation must be carried out.

Example NBC CDR

AREAM/NDEL1//
ZULUM/222300ZNOV1999/230000ZNOV1999/230600ZNOV1999//
UNITM/-/DGT/KPH/C//
WHISKEYM/090/011/5/20/4/-/1//
XRAYM/090/010/6/19/5/-/0//
YANKEEM/090/005/6/18/5/-/0//



Example NBC 2 ROTA

ALFA/US/A234/008/RC//
CHARLIE/230100ZNOV1999//
FOXTROT/32UPG387764/AA//
GOLF/OBS/-/-/TPT/SML//
INDIA/SURF/2480/NP/-//
MIKER/SPILL//
TANGO/FLAT/URBAN//
YANKEE/090DGT/011KPH//
ZULU/5/20C/4/-/1//
GENTEXT/NBCINFO/RUPTURE OF 200 LITRES DRUM DROPPED FROM FLATBED TRUCK//

Figure 14-I.
Type T, Case 4. Small Methyl Isocyanate (UN/NA ID#2480) Spill at Night.

e. **Case 5. Releases from a Bulk Storage Tank.** Chemical storage tanks can contain thousands of litres of TIC. Many of these chemicals exist as gases under atmospheric conditions and are stored as a liquid under high pressure and low temperatures. Some of the chemicals are extremely flammable as a vapour cloud. Damage to one of these tanks can result in the stored liquid being ejected very quickly as a large pool of very cold liquid. The pool will evaporate to form a vapour cloud which is considerably more dense than the surrounding air due to the lower temperature and differences in molecular weight. This cloud will initially be affected more by gravity than the wind. The cloud will begin to dilute by being mixed with surrounding air. Eventually, the cloud will no longer be denser than the air and will move with the air as any other vapour or aerosol cloud. At this point, however, the cloud concentration will most likely be low enough that it is no longer toxic. So, any prediction procedures must focus on the behaviour of the cloud before it has been diluted. This behaviour will be different than that predicted by assuming the hazard area resulting from the use of the ERG. Several computer models have been developed to predict cloud behaviour from such releases. Some of the models also address the flammability of the cloud. These models are very complex and will not be discussed here. The simplified hazard areas are comprised of a circle with the release location at its centre. The radius of the circle should be 2 km under daytime and 6 km under night time.

1408. Hazard Prediction for Elevated Releases

1. **Procedure.** If the release's momentum or buoyancy carries the material significantly (> 50 m) above the ground surface and the material extends continuously from near the ground to high elevation, then in addition to the calculations done using 10 m wind conditions, the hazard prediction should be repeated using the wind conditions from the NBC BWR at 2000 m elevation. The hazard area for an elevated release is considered to be the combined hazard areas, including spaces in between (see Figure 14-II).

2. **Overlap of Hazard Areas.** If merging or combining hazard regions for elevated releases or changing meteorological conditions involves two triangular hazard regions having downwind directions different by more than 90 DEG, the regions to be merged should be replaced with a circle of radius equal to the larger of the downwind distances. The time of arrival at a location should be the earliest time resulting from either the BWR or CDR.

3. Changes in meteorological conditions in following BWRs should be handled in the same manner as using CDRs.

Example NBC CDR

AREAM/NDEL1//
ZULUM/231100ZNOV1999/231200ZNOV1999/231800ZNOV1999//
UNITM/-/DGT/KPH/C//
WHISKEYM/090/020/3/15/4/-/1//
XRAYM/090/020/3/17/5/-/1//
YANKEEM/090/020/2/18/5/-/0//

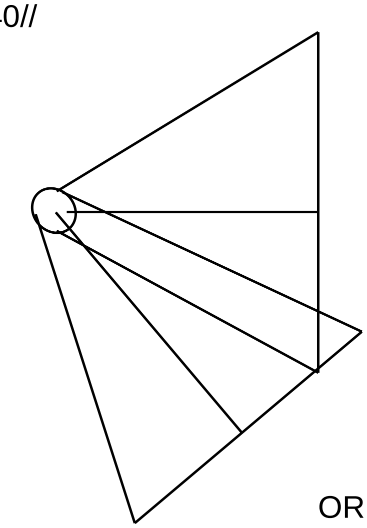
Example NBC BWR

AREAM/NDEL1//
ZULUM/231100ZNOV1999/231200ZNOV1999/231800ZNOV1999//
UNITM/-/DGT/KPH/C//
LAYERM/02/315/030/04/320/035/06/345/040//

.

Example NBC 2 ROTA

ALFA/US/A234/008/RC//
CHARLIE/231300ZNOV1999//
FOXTROT/32UPG387764/AA//
GOLF/OBS/-/-/STK/SML//
INDIA/SURF/GB/NP/-//
MIKER/FIRE//
TANGO/FLAT/BARE//



YANKEE/090DGT/020KPH//
ZULU/3/15C/4/-/1//
GENTEXT/NBCINFO/ELEVATED PLUME
FROM SINGLE PALLET OF GB ROCKETS
REACHING 500 METER ELEVATION//

Figure 14-II. Type T, Case 4. GB Rocket Stockpile Fire During the Day.

1409. Reporting of ROTA Events within the NBC Warning and Reporting System

1. **General.** NATO forces will utilise the existing NBC Warning and Reporting System and associated message formats to report ROTA events. Initial reports of ROTA events will utilise the NBC 1 ROTA report if the release location is known; otherwise, a NBC 4 ROTA report will be generated. The NBC Centre may use this information to develop a NBC 2 ROTA report, a simplified hazard prediction and a NBC 3 ROTA report. Additional readings from monitoring and directed surveys of the hazard area will use the NBC 4 ROTA report. The NBC Centre will use this information to develop a plot of the actual contamination and the NBC 5 ROTA report and, finally, the system will use the NBC 6 ROTA report to pass additional information required for detailed prediction.

2. **Identification.** ROTA messages are identified as NBC 1 to 6 messages with the entry ROTA replacing the respective NUC, BIO and CHEM entries in NBCEVENT. Entries N, B, and C are replaced by RN, RB, and RC in field 4 of set ALFA.

3. **NBC 1 ROTA.** This report provides the observer's initial report if the location of the source is known. The report will include sets BRAVO, CHARLIE, GOLF, INDIA and TANGO and may include the sets ALFA, FOXTROT, MIKER, YANKEE, ZULU and GENTEXT with the information as currently described for NBC reports. Set CHARLIE provides the same information as set DELTA, except it indicates an observed ROTA event rather than an observed attack. Set GOLF will include the type of delivery, if applicable, and the ROTA type of container such as bunker (BUK), waste (WST), reactor (RCT), transport (TPT) or stockpile (STK), pressurised bottle (BTL), storage container (CON), 200 litres drum (DRM), storage tank (TNK), if known, in field 4. Field 5 of set GOLF will indicate the size of the release as small (SML), large (LRG) or extra large (XLG), if appropriate. Field 1 of set INDIA will indicate the observed release height. Field 2 of set INDIA will indicate the type of release as described above as RNP, TIM or the agent name or identification number. Field 3 of set INDIA will indicate the material persistency. Additional descriptive entries for a ROTA event can be entered into set MIKER. The set TANGO will indicate a description of the terrain/topography and the vegetation. The sets YANKEE and ZULU may indicate locally observed weather. Set GENTEXT will provide, if available, further information concerning the level of radiation detected, the specific chemical compound or the type of biological agent.

4. **NBC 2 ROTA.** The NBC Centre may assign a Strike Serial Number (ALFA) to the NBC 1 report and transmit the information as a NBC-2 report.

5. **NBC 3 ROTA.** This report provides a prediction of the ROTA hazard area in order to provide rapid force protection for NATO forces. The report will use the information as described in this manual for sets ALFA, CHARLIE, FOXTROT, GOLF, INDIA, PAPAA, PAPAX, YANKEE, ZULU, and GENTEXT. The hazard area location is described in set PAPAX, with the defining RELEASE AREA radius and PROTECTIVE ACTION DISTANCE summarised in set PAPAA. Set XRAYA may be used to report contours for measured areas of air contamination.

6. **NBC 4 ROTA.** This report is utilised either to pass subsequent off-target monitoring data or the results of a deliberate directed survey. The report will use the information as described in ATP-45 for sets ALFA, INDIA, QUEBEC, ROMEO, SIERRA, TANGO, WHISKEY, YANKEE, and ZULU. Set GENTEXT in this message will provide the initial background reading taken by the survey team for nuclear or radiological releases. Readings for set ROMEO will indicate readings above the initial reported background reading and measured values for chemical and biological. Decimals may be entered into set ROMEO if readings below 1 in the relevant unit of measurement are recorded e.g. 0.123456 cGy/hr.

7. **NBC 5 ROTA.** This report will outline the actual extent of the ROTA ground contamination from survey data. The report will use the information as described above for sets ALFA, CHARLIE, INDIA, YANKEE, ZULU, and GENTEXT. Set OSCAR indicates the time for which the contour is appropriate. Set XRAYA will describe the level of contamination for the contour and the ground contaminated area resulting from any ROTA event whether it is Nuclear, Biological or Chemical.

8. **NBC 6 ROTA.** This message will be used to provide, in set GENTEXT, specific information required to produce a more detailed ROTA hazard prediction.

CHAPTER 15

METEOROLOGICAL FACTORS

1501. Aim.

1. The aim of this chapter is to describe the meteorological factors which influence the hazard resulting from a nuclear, biological, chemical, or ROTA release and to describe the different meteorology messages used for predicting the associated warning areas.

1502. Influence of Weather on the Effectiveness of NBC or ROTA Materials

a. Temperature.
The rate of evaporation of a liquid chemical agent or toxic industrial chemical varies with the temperature. High temperatures will increase the rate of evaporation while lower temperatures will decrease it. Initially, the vapour hazard of both persistent and non-persistent agents will be greater at higher temperatures, while the duration of the liquid contamination and vapour hazard will be shorter. Lower temperatures will have just the opposite effect. It should be noted that lower temperatures may actually reduce or even eliminate casualty potential. However, a contact hazard may remain for several days. Temperature is not expected to have any significant effect on the hazard area resulting from a biological attack or ROTA nuclear or biological release.

b. Air Stability Category.
The air stability category describes the degree of mixing of a released agent with the air in the lower atmosphere. There are three general air stability categories:

(1) Stable.
Under stable conditions there is little mixing and thus higher concentrations, and the agent cloud will be effective over long distances.

(2) Neutral.
Neutral conditions, the intermediate range for mixing, are most common.

(3) Unstable.
Under unstable conditions there is strong mixing and thus shorter hazard distances.

c. Wind.
The wind speed and direction will affect the spread of nuclear, biological, chemical or ROTA clouds. High winds increase the rate of evaporation of liquid chemical agent and the rate at which chemical clouds are dissipated. The effect on persistent agent attacks is variable. Large area non-persistent agent attacks are most effective in winds not exceeding 28 km/h. Small area non-persistent agent attacks are most effective in winds not exceeding 10 km/h. High winds generally increase the effectiveness of massive non persistent agent surprise attacks.

d. Humidity and Precipitation.
Humidity and precipitation alter the effects of chemical agents in different ways. High humidity, for example, will increase the effectiveness of blister agents, but will not directly affect the effectiveness of nerve agents. Humidity will alter the effects of biological agents in different ways. Very low humidity will decrease the effectiveness by increasing the rate at which agents dry out from atmospheric exposure.
Heavy or continuous rain will wash away liquid chemical contamination, and light rain after a liquid attack can cause the recurrence of a contact hazard.
Rain after a blister or persistent nerve agent attack will temporarily increase the evaporation rate, thus increasing the vapour hazard. Snow reduces the evaporation rate of liquid chemical agent, thus reducing the vapour hazard in the attack area.
Heavy or continuous rain will locally reduce nuclear and biological contamination by washing it out of the air.

e. Inversion Layers.
In most cases the concentration of the biological agent will decrease with increasing height and reach a low concentration at approximately 800 metres altitude. Normally there will be no risk above 3000 metres above ground. Certain meteorological conditions in the atmosphere, known as inversion layers are associated with stable conditions specified in the NBC CDR under the term "stability category". Stable conditions usually occur at night or in the morning under conditions of clear skies and low wind speed but will also result any time the ground or water surface is cooler than the air above it. An elevated inversion layer occurs when the surface inversion layer decays. With both inversion and elevated inversion layers the concentration of the biological agent will be higher within the layer than with no inversion. The concentration of the biological agent will be very small above the layer. If the height of the top of any inversion layer is lower than 800 metres, this will be indicated in the NBC CDR by the letter "A" appearing in the coded "significant weather phenomena". If the height of the top is lower than 400 metres, letter "B" is to be used, if lower than 200 metres, letter "C". These letters signify the lowest safe altitudes for aircraft to avoid airborne contamination.

f. Sunlight and Air Exposure.
Most biological agents will lose their viability or toxicity with time after exposure to the atmosphere. Most biological agents will have a greater rate of loss of viability or toxicity when exposed to bright sunlight.

1503. Influence of Terrain on the Effectiveness of NBC or ROTA Materials

1. The path and speed of an airborne cloud is considerably influenced by the nature of the terrain in the downwind area. Contaminant clouds can flow over rolling terrain and down valleys. Dangerous concentrations may persist in hollows, depressions and trenches. The contaminant clouds tend to go over or around obstacles such as hills, but tend to be retarded by rough ground, tall grass and bushes. Flat terrain allows for an even, steady movement.

1504. Meteorological Definitions

a. Downwind Direction:
The mean surface downwind direction towards which, the airborne cloud travels in the warning area. The optimal measuring height should be 10 m above the ground in open terrain averaged over a period of 10 minutes.

b. Downwind Speed:
The mean surface downwind speed in the warning area. The optimal measuring height should be 10 m above the ground in open terrain averaged over a period of 10 minutes.

c. Air Stability Category:
The stability category is normally reported in the NBC CDR. If it must be determined locally use Table 15-I and Table 15-II.

d. When above listed measurements are taken, the results will be the actual Downwind Direction, the Downwind Speed and the Air Stability Category at the time and location of the measurement. When the values are given in a NBC CDM, they will represent average values for the given NBC CDM area in the given 2 hour period.

1505. The NBC Chemical Downwind Message. (NBC CDM)

a. Biological Use.
The meteorological data required for the biological downwind hazard prediction procedure is contained in the NBC Chemical Downwind Message (NBC CDM).

b. Transmission.
The NBC CDM is transmitted at least 4 times a day, and each message is valid for a 6 hours period. Each 6 hours period is subdivided into three 2 hours periods. The NBC CDM can be sent down as far as source level.

c. Content.
The NBC CDM contains the following information:

- Area of validity.
- Date-time groups for time of observation, time valid from and time valid to.
- Units of measurement.
- Downwind direction and downwind speed.
- Air stability category.
- Surface air temperature.
- Relative Humidity.
- Significant weather phenomena.
- Cloud coverage.

d. Validity and Format.
The NBC CDM contains weather information valid for 6 hours. The NBC Chemical Downwind Forecast (NBC CDF) has the same content, but the period of validity is more than 6 hours ahead. The NBC CDM and NBC CDF can be contained in a data format, the NBC Chemical Downwind Report (NBC CDR). The detailed computer generated format for the NBC CDM/CDF and the NBC CDR is explained in ATP-45, Annex B.

e. Sample Content of a Computer Generated NBC CDM.

AREAM/NDEL1//
ZULUM/231100ZNOV1999/231200ZNOV1999/231800ZNOV1999//
UNITM/-/DGT/KPH/C//
WHISKEYM/070/022/6/15/-/-/1//
XRAYM/075/025/4/13/9/6/2//
YANKEEM/080/028/4/12/8/-/2//

f. Local Meteorology.
Local meteorology should be assimilated into the CDM. Weighting should be assigned for each local observation based on confidence in how well it represents the region.

g. CDM Area Selection.
The NBC CDM used in calculations is based on the location in FOXTROT. If multiple FOXTROT locations exist, the mean location should be determined and the NBC CDM provided for that location. If the single FOXTROT or mean location lies on the border between two CDM areas, the NBC CDM for either area may be used.

1506. Meteorological Requirements

1. It is the task of a NBC Centre to predict nuclear, biological, chemical and ROTA warning areas for airborne clouds.

2. For this purpose the NBC Centre must have the necessary meteorological information. National and/or NATO directives must ensure the provision of applicable NBC CDRs, and national or local SOPs must list directives for the observation and dissemination of local weather information. For more accurate warning area estimates, a record of actual local meteorological conditions should be maintained and disseminated.

Morning (AM)			
Sun Elevation Angle	**Condition of sky**		
	No clouds/ Less than half covered	More than half covered	Overcast
< 4°	S	S	N
> 4° - 32°	N	N	N
> 32° - 40°	U	N	N
> 40°	U	U	N

U = Unstable N = Neutral S = Stable

Afternoon (PM)			
Sun Elevation Angle	**Condition of sky**		
	No clouds/ Less than half covered	More than half covered	Overcast
> 46°	U	U	N
> 35° - 46°	U	N	N
> 12° - 35°	N	N	N
> 5° - 12°	S	N	N
< 5°	S	S	N

Table 15-I, Determination of Stability Category.

Enter with:
- Time of day.
- Degree of cloud coverage.
- Sun elevation angle (night less than 4 degrees).

Note 1: The stability category found in this table must be adjusted by using Table 15-II.

Note 2: The sun elevation table contains basic information. Nations may convert the table into a suitable format for their own use.

Specific ground (terrain) and Weather influences	**Stability Category from Table 15-I**		
	U	**N**	**S**
Dry to slightly moist surface.	**U**	**N**	**S**
Wet surface (i.e. after continuous rain) or dew.	**N**	**N**	**S**
Frozen surface or partly covered with snow, ice or hoarfrost.	**N**	**S**	**S**
Surface completely covered with snow.	**S**	**S**	**S**
Continuous rainfall (no shower activity).	**N**	**N**	**N**
Haze or mist (visibility 1 - 4 km).	**N**	**N**	**S**
Fog (visibility less than 1 km).	**N**	**S**	**S**
Downwind speed more than 18 KPH.	**N**	**N**	**N**

Table 15-II, Stability Category Adjustment.

Table 15-II is used for adjustment of the stability category found from Table 15-I, taking into account influences of surface and weather. All eight conditions of terrain and weather listed in Table 15-II must be checked, and in case of doubt the most stable category is to be chosen.

ANNEX A

NOMOGRAMS - TABLES - GRAPHS

The user may enlarge the illustrations contained in this annex.

During the enlargement process care must be taken to maintain the accuracy of the illustrations.

A list of the nomograms, tables and graphs in this annex appears in the Table of Contents (Page XVII)

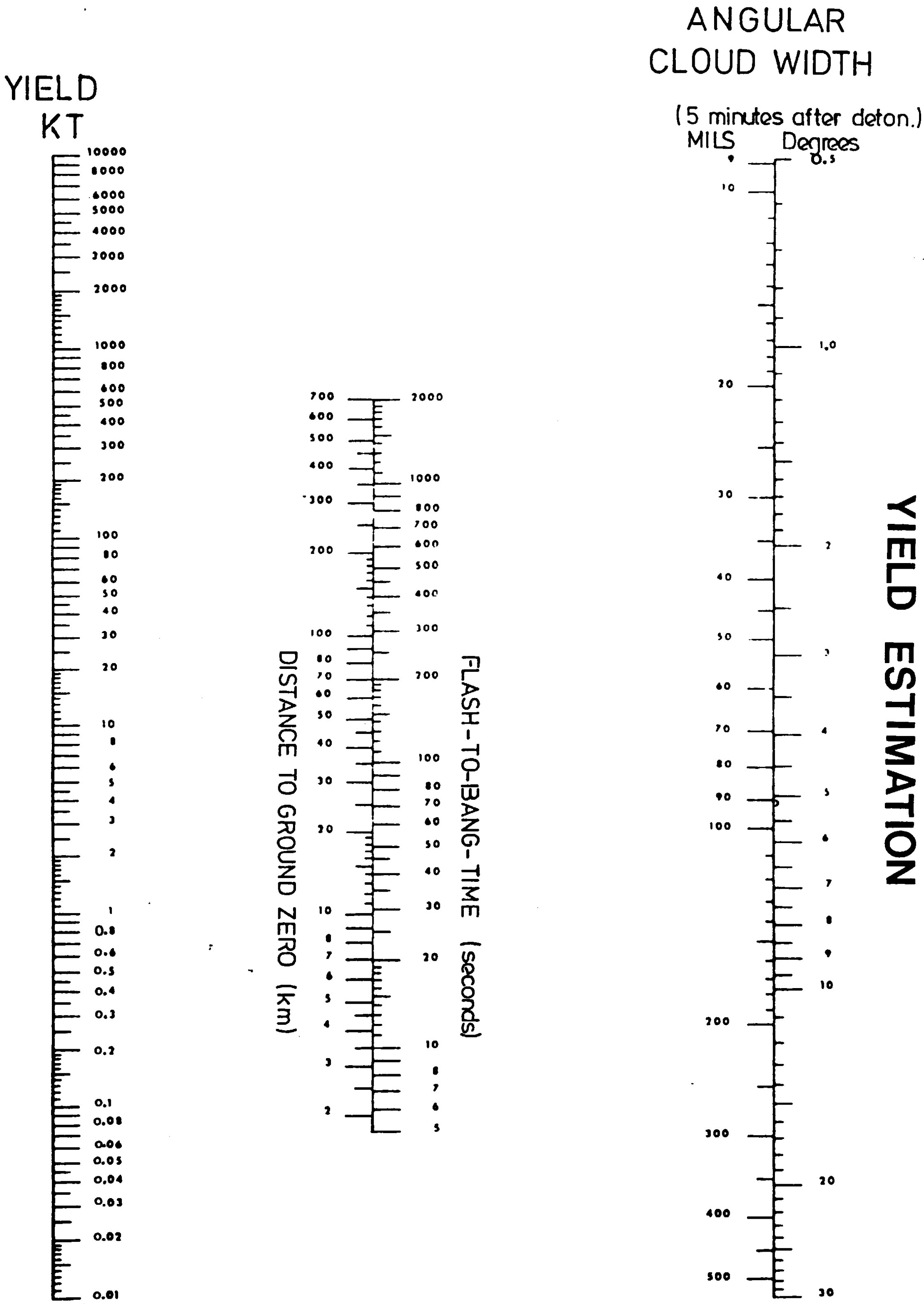


Figure A-I
Yield Estimation, Angular Cloud Width and Flash-to-Bang-Time/Distance to Ground Zero.

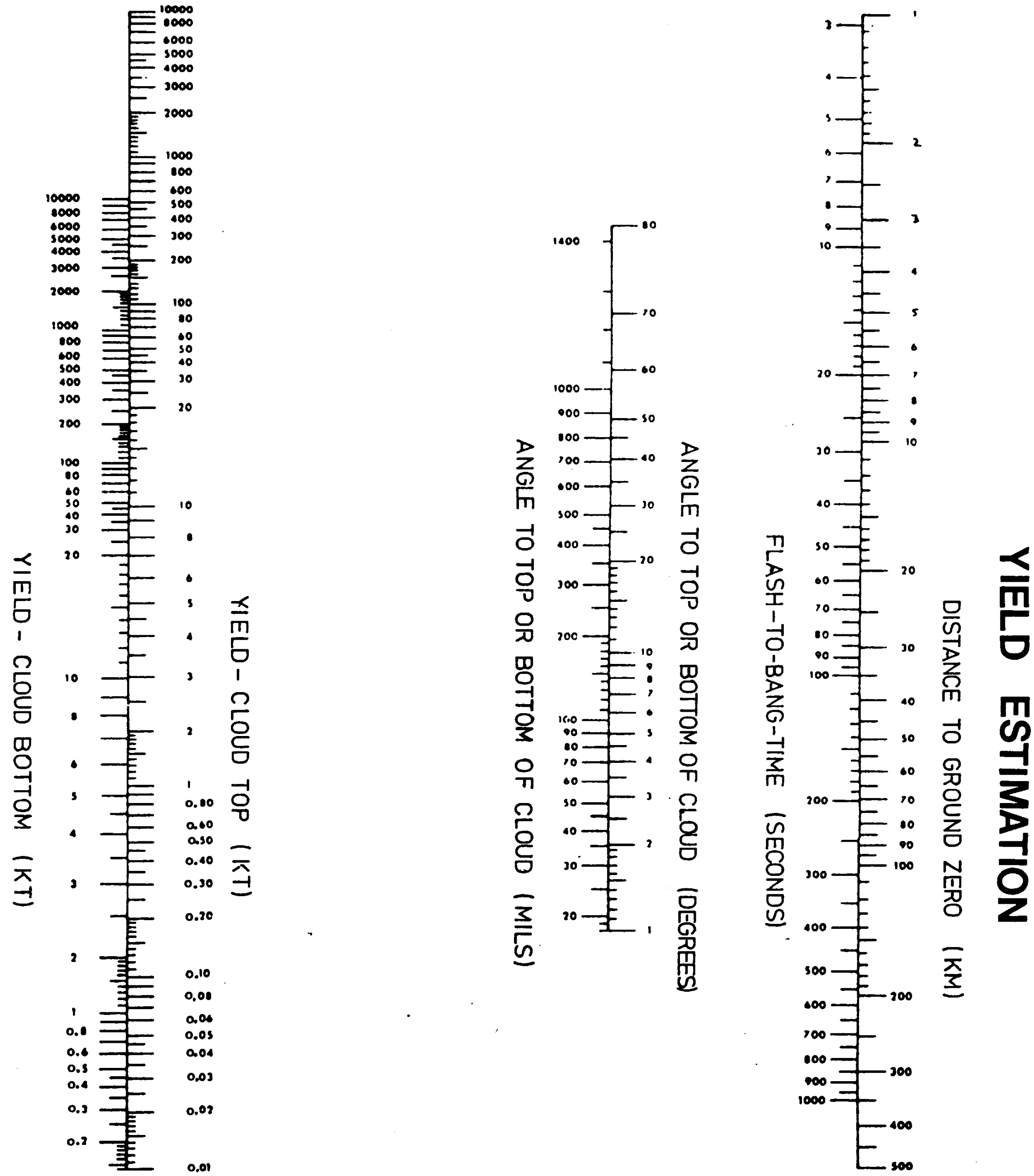


Figure A-II
Yield Estimation, Angle to Top/Bottom of Cloud and Flash-to-Bang-Time/Distance to Ground Zero.

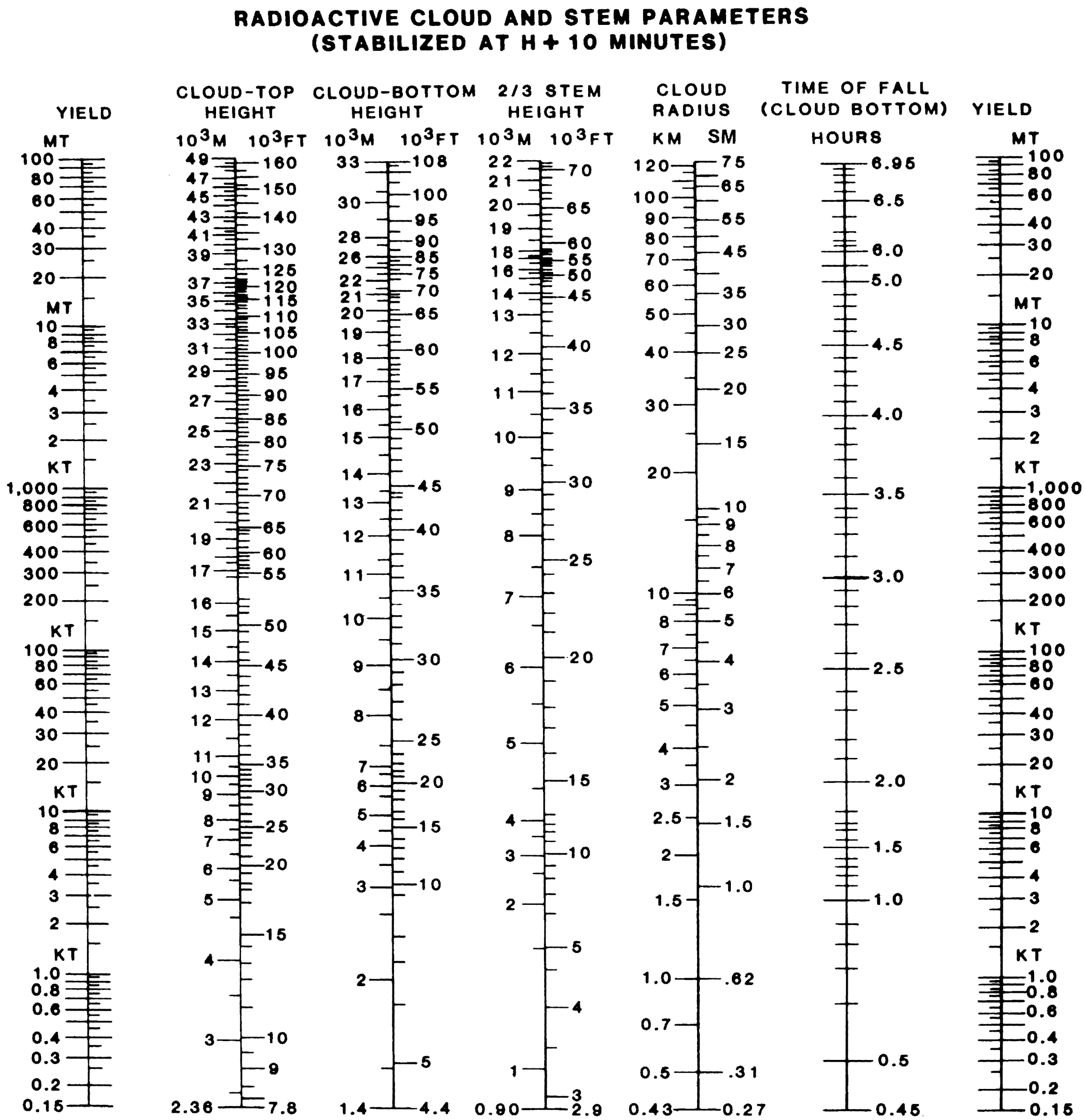


Figure A-III
Stabilised Cloud and Stem Parameters.

WIND SPEED km/h	ALTITUDE LAYERS (Thousands of Metres)											
	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-22	22-30	> 30
5	6.8	5.8	5.2	5.0	4.8	4.4	4.2	4.0	3.8	3.8	3.6	3.4
10	13.6	11.8	10.4	10.0	9.6	9.0	8.4	8.0	7.8	7.6	7.2	6.8
15	20.4	17.6	15.6	15.0	14.4	13.4	12.6	12.0	11.6	11.2	10.8	10.2
20	27.2	23.6	20.8	20.0	19.2	18.0	16.8	16.0	15.6	15.0	14.2	13.6
25	34.0	29.4	26.0	25.2	24.0	22.4	21.0	20.0	19.4	18.8	17.8	17.0

Figure A-IV, Map Distance in cm, Map Scale 1:50 000, Wind Speed in KM/H

WIND SPEED knots	ALTITUDE LAYERS (Thousands of Metres)											
	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-22	22-30	> 30
5	12.6	11.0	9.6	9.4	9.0	8.4	7.8	7.4	7.2	7.0	6.6	6.4
10	25.2	21.8	19.2	18.6	17.8	16.6	15.6	14.8	14.4	14.0	13.2	12.6
15	37.8	32.8	28.8	28.0	26.8	25.0	23.4	22.2	21.6	20.8	19.6	19.0
20	50.4	43.6	38.4	37.2	35.6	33.2	31.2	29.6	28.8	27.8	26.2	25.2
25	63.0	54.6	48.0	46.6	44.6	41.2	39.0	37.0	36.0	34.8	32.8	31.6
30	65.6	65.4	57.6	55.8	53.4	49.8	46.8	44.4	43.2	41.8	39.4	37.8

Figure A-V, Map Distance in cm, Map Scale 1:50 000, Wind Speed in Knots

Note: Above 18 000 metres, altitude layers for plotting vector diagrams continue to be at 2 000 meter intervals. However, the map distance factors vary so little that some of the columns in the above tables are combined for convenience.

WIND SPEED km/h	ALTITUDE LAYERS (Thousands of Metres)											
	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-22	22-30	> 30
5	3.4	2.9	2.6	2.5	2.4	2.2	2.1	2.0	1.9	1.9	1.8	1.7
10	6.8	5.9	5.2	5.0	4.8	4.5	4.2	4.0	3.9	3.8	3.6	3.4
15	10.2	8.8	7.8	7.5	7.2	6.7	6.3	6.0	5.8	5.6	5.4	5.1
20	13.6	11.8	10.4	10.0	9.6	9.0	8.4	8.0	7.8	7.5	7.1	6.8
25	17.0	14.7	13.0	12.6	12.0	11.2	10.5	10.0	9.7	9.4	8.9	8.5
30	20.4	17.7	15.6	15.1	14.4	13.4	12.6	12.0	11.7	11.3	10.7	10.2
35	23.8	20.6	18.1	17.6	16.8	15.7	14.7	14.0	13.6	13.1	12.5	11.9
40	27.2	23.6	20.7	20.1	19.2	17.9	16.8	16.0	15.6	15.0	14.3	13.6
45	30.6	26.5	23.3	22.6	21.6	20.2	19.0	18.0	17.5	16.9	16.1	15.3
50	34.0	29.5	25.9	25.1	24.0	22.4	21.1	20.0	19.4	18.8	17.9	17.0

Figure A-VI, Map Distance in cm, Map Scale 1:100 000, Wind Speed in KM/H

WIND SPEED	ALTITUDE LAYERS (Thousands of Metres)											
knots	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-22	22-30	> 30
5	6.3	5.5	4.8	4.7	4.5	4.2	3.9	3.7	3.6	3.5	3.3	3.2
10	12.6	10.9	9.6	9.3	8.9	8.3	7.8	7.4	7.2	7.0	6.6	6.3
15	18.9	16.4	14.4	14.0	13.4	12.5	11.7	11.1	10.8	10.4	9.8	9.5
20	25.2	21.8	19.2	18.6	17.8	16.6	15.6	14.8	14.4	13.9	13.1	12.6
25	31.5	27.3	24.0	23.3	22.3	20.6	19.5	18.5	18.0	17.4	16.4	15.8
30	37.8	32.7	28.8	27.9	26.7	24.9	23.4	22.2	21.6	20.9	19.7	18.9
35	44.1	38.2	33.6	32.6	31.2	29.1	27.3	25.9	25.2	24.3	22.9	22.1
40	50.4	43.6	38.4	37.2	35.6	33.2	31.2	29.6	28.8	27.8	26.2	25.2
45	56.7	49.1	43.2	41.9	40.1	37.4	35.1	33.3	32.4	31.3	29.5	28.4
50	63.0	54.5	48.0	46.5	44.5	41.5	39.0	37.0	36.0	34.8	32.8	31.5

Figure A-VII, Map Distance in cm, Map Scale 1:100 000, Wind Speed in Knots

Note: Above 18 000 metres, altitude layers for plotting vector diagrams continue to be at 2 000 meter intervals. However, the map distance factors vary so little that some of the columns in the above tables are combined for convenience.

WIND SPEED	ALTITUDE LAYERS (Thousands of Metres)											
km/h	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-22	22-30	> 30
5	1.4	1.2	1.0	1.0	1.0	0.9	0.8	0.8	0.8	0.8	0.7	0.7
10	2.7	2.4	2.1	2.0	1.9	1.8	1.7	1.6	1.6	1.5	1.4	1.4
15	4.1	3.5	3.1	3.0	2.9	2.7	2.5	2.4	2.3	2.3	2.1	2.0
20	5.4	4.7	4.1	4.0	3.8	3.6	3.4	3.2	3.1	3.0	2.9	2.7
25	6.8	5.9	5.2	5.0	4.8	4.5	4.2	4.0	3.9	3.8	3.6	3.4
30	8.2	7.1	6.2	6.0	5.8	5.4	5.1	4.8	4.7	4.5	4.3	4.1
35	9.5	8.2	7.3	7.0	6.7	6.3	5.9	5.6	5.4	5.3	5.0	4.8
40	10.9	9.4	8.3	8.0	7.7	7.2	6.7	6.4	6.2	6.0	5.7	5.4
45	12.2	10.6	9.3	9.0	8.6	8.1	7.6	7.2	7.0	6.8	6.4	6.1
50	13.6	11.8	10.4	10.0	9.6	9.0	8.4	8.0	7.8	7.5	7.1	6.8
55	15.0	12.9	11.4	11.0	10.6	9.9	9.3	8.8	8.6	8.3	7.9	7.5
60	16.3	14.1	12.4	12.0	11.5	10.8	10.1	9.6	9.3	9.0	8.6	8.2
75	20.4	17.7	15.5	15.1	14.4	13.4	12.6	12.0	11.7	11.3	10.7	10.2
100	27.2	23.5	20.7	20.1	19.2	17.9	16.9	16.0	15.6	15.0	14.3	13.6

Figure A-VIII, Map Distance in cm, Map Scale 1:250 000, Wind Speed in KM/H

WIND SPEED	ALTITUDE LAYERS (Thousands of Metres)											
knots	0-2	2-4	4-6	6-8	8-10	10-12	12-14	14-16	16-18	18-22	22-30	> 30
5	2.5	2.2	1.9	1.9	1.8	1.7	1.6	1.5	1.4	1.4	1.3	1.3
10	5.0	4.4	3.8	3.7	3.6	3.3	3.1	3.0	2.9	2.8	2.6	2.5
15	7.6	6.5	5.8	5.6	5.3	5.0	4.7	4.4	4.3	4.2	3.9	3.8
20	10.1	8.7	7.7	7.4	7.1	6.6	6.2	5.9	5.8	5.6	5.2	5.0
25	12.6	10.9	9.6	9.3	8.9	8.3	7.8	7.4	7.2	7.0	6.6	6.3
30	15.1	13.1	11.5	11.2	10.7	10.0	9.4	8.9	8.6	8.3	7.9	7.6
35	17.6	15.3	13.4	13.0	12.5	11.6	10.9	10.4	10.1	9.7	9.2	8.8
40	20.2	17.4	15.4	14.9	14.2	13.3	12.5	11.8	11.5	11.1	10.5	10.1
45	22.7	19.6	17.3	16.7	16.0	14.9	14.0	13.3	13.0	12.5	11.8	11.3
50	25.2	21.8	19.2	18.6	17.8	16.6	15.6	14.8	14.4	13.9	13.1	12.6
55	27.7	24.0	21.1	20.5	19.6	18.3	17.2	16.3	15.8	15.3	14.4	13.9
60	30.2	26.2	23.0	22.3	21.4	19.9	18.7	17.8	17.3	16.7	15.7	15.1
75	37.8	32.7	28.8	27.9	26.7	24.9	23.4	22.2	21.6	20.9	19.7	18.9
100	50.4	43.6	38.4	37.2	35.6	33.2	31.2	29.6	28.8	27.8	26.2	25.2

Figure A-IX, Map Distance in cm, Map Scale 1:250 000, Wind Speed in Knots

Note: Above 18 000 metres, altitude layers for plotting vector diagrams continue to be at 2 000 meter intervals. However, the map distance factors vary so little that some of the columns in the above tables are combined for convenience.

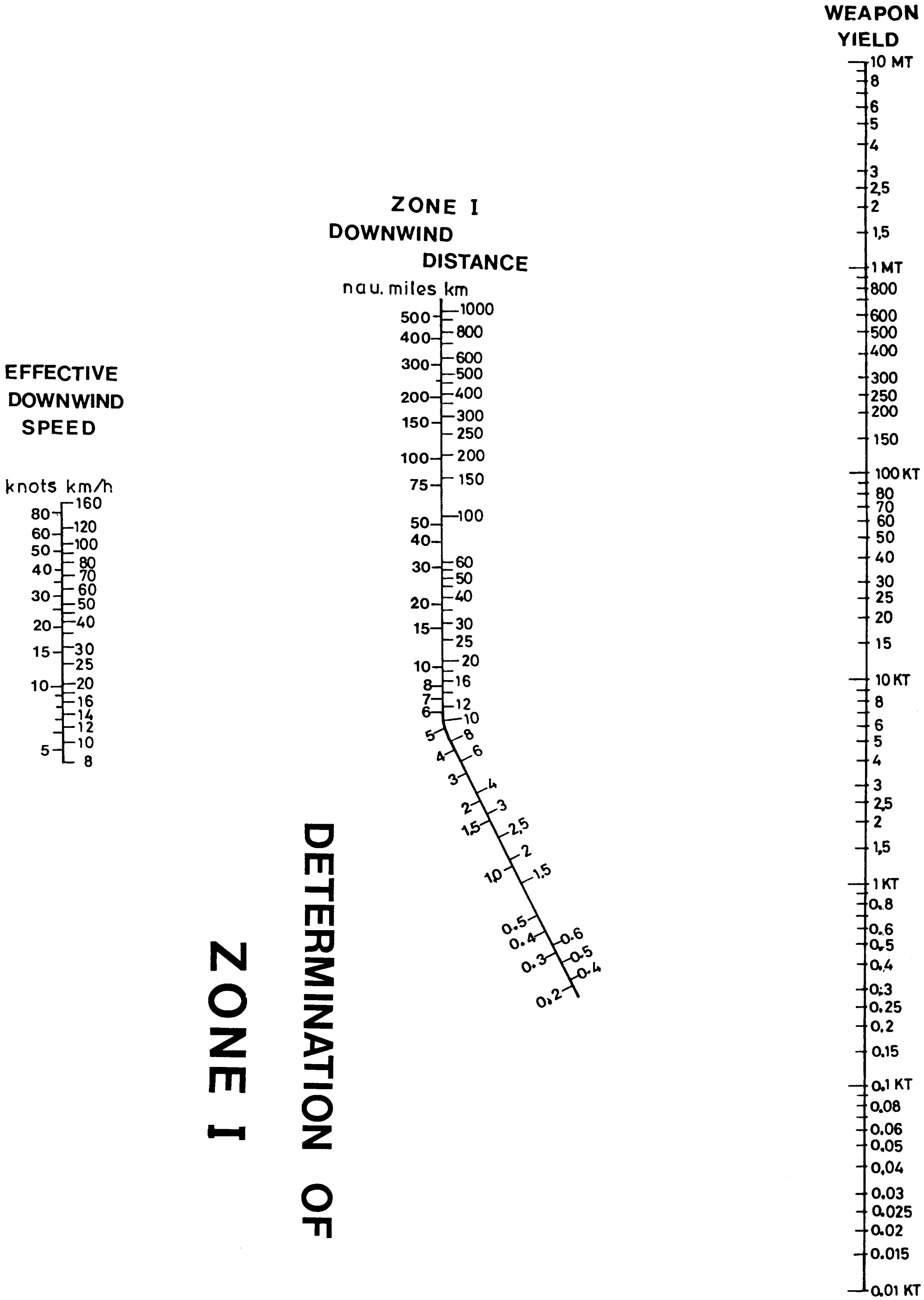


Figure A-X, Determination of Zone I, Downwind Distance.

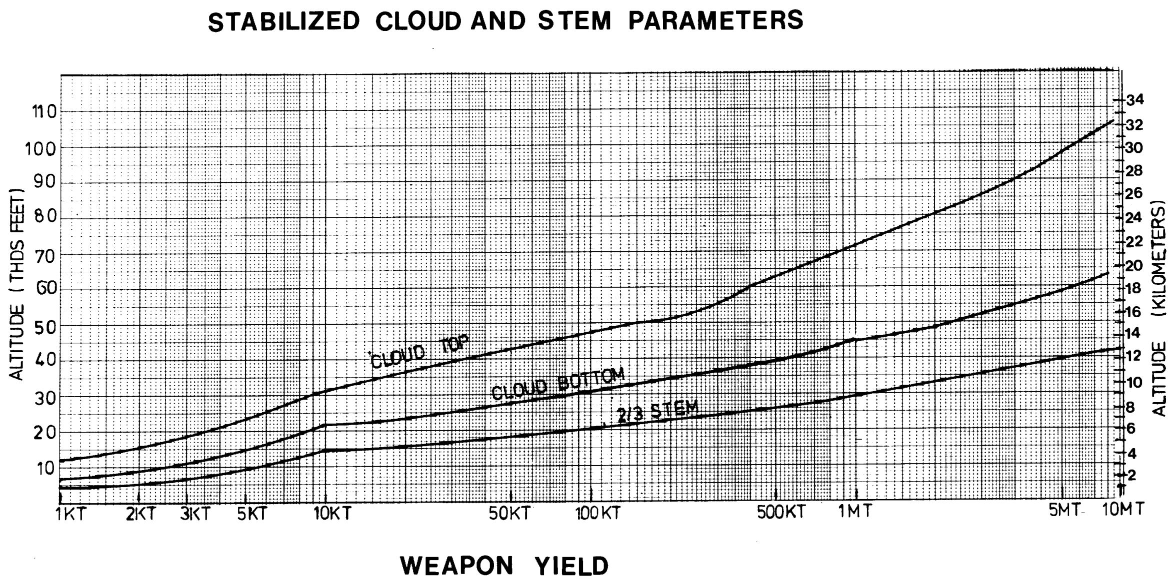


Figure A-XI, Stabilised Cloud and Stem Parameters (Graph)

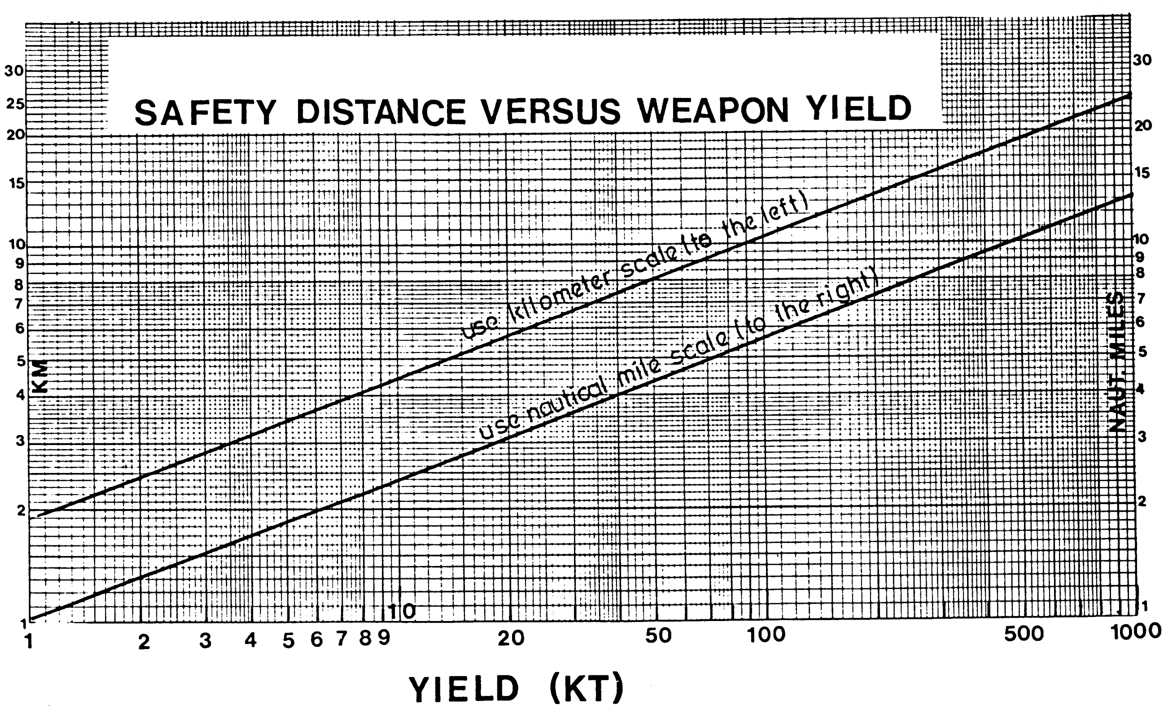


Figure A-XII, Safety Distance as a Function of Weapon Yield.

CONVERSION TABLE

To convert	To	Multiply by
Kilometres	Miles	0.62
Kilometres	Nautical Miles	0.54
Miles	Kilometres	1.61
Miles	Nautical Miles	0.87
Nautical Miles	Kilometres	1.85
Nautical Miles	Miles	1.15
metres	feet	3.28
feet	metres	0.30
mph	km/h	1.61
mph	knots	0.87
mph	m/sec	0.45
mph	ft/sec	1.47
km/h	mph	0.62
km/h	knots	0.54
km/h	m/sec	0.28
km/h	ft/sec	0.91
knots	km/h	1.85
knots	mph	1.15
knots	m/sec	0.51
knots	ft/sec	1.69
m/sec	km/h	3.60
m/sec	mph	2.24
m/sec	knots	1.94
m/sec	ft/sec	3.28
ft/sec	km/h	1.10
ft/sec	mph	0.68
ft/sec	knots	0.59
ft/sec	m/s	0.30
kilograms	pounds (lb)	2.20
pounds (lb)	kilograms	0.45
gallons (US)	litres	3.79
litres	gallons (US)	0.26

Figure A-XIII, Conversion Table and Distance Conversion Factors.

Figure A-XIV, Intentionally left blank

Degrees	Mils	Degrees	Mils	Degrees	Mils	Degrees	Mils
1	17.78	65	1,155.55	165	2,933.33	265	4,711.11
2	35.55	70	1,244.44	170	3,022.22	270	4,800.00
3	53.33	75	1,333.33	175	3,111.11	275	4,888.89
4	71.11	80	1,422.22	180	3,200.00	280	4,977.78
5	88.89	85	1,511.11	185	3,288.89	285	5,066.67
6	106.67	90	1,600.00	190	3,377.78	290	5,155.55
7	124.44	95	1,688.89	195	3,466.67	295	5,244.44
8	142.22	100	1,777.78	200	3,555.55	300	5,333.33
9	160.00	105	1,866.67	205	3,644.44	305	5,422.22
10	177.78	110	1,955.55	210	3,733.33	310	5,511.11
15	266.67	115	2,044.44	215	3,822.22	315	5,600.00
20	355.55	120	2,133.33	220	3,911.11	320	5,688.89
25	444.44	125	2,222.22	225	4,000.00	325	5,777.78
30	533.33	130	2,311.11	230	4,088.89	330	5,866.67
35	622.22	135	2,400.00	235	4,177.78	335	5,955.55
40	711.11	140	2,488.89	240	4,266.67	340	6,044.44
45	800.00	145	2,577.78	245	4,355.55	345	6,133.33
50	888.89	150	2,666.67	250	4,444.44	350	6,222.22
55	977.78	155	2,755.55	255	4,533.33	355	6,311.11
60	1,066.67	160	2,844.44	260	4,622.22	360	6,400.00

Figure A-XV, Conversion Table, Degrees to Mils.

Environmental shielding	Transmission Factor (TF)	Protection Factor (PF)
Armoured Vehicles:		
M1 Tank	0,04	25
M48 Tank	0,02	50
M60 Tank	0,04	25
M2 IFV	0,2	5
M3 CFV	0,2	5
M113 Armoured Personnel Carrier	0,3	3,33
M109 Special Purpose Howitzer	0,2	5
M548 Cargo Vehicle	0,7	1,43
M88 Recovery Vehicle	0,09	11,11
M577 Command Post Carrier	0,3	3,33
M551 Armoured Recon Airborne Assault Vehicle	0,2	5
M728 Combat Engineer Vehicle	0,04	25
Trucks:		
1/4-ton	0,8	1,25
3/4-ton	0,6	1,67
2½-ton	0,6	1,67
4 - 7-ton	0,5	2
Structures:		
Multistorey building:		
Top floor	0,01	100
Lower floor	0,1	10
Frame house:		
First floor	0,6	1,67
Basement	0,1	10
Urban Areas: (In open)	0,7 *	1,43 *
Woods:	0,8 *	1,25 *
Underground shelters:	0,0002	5000
Foxholes:	0,1	10

* These factors apply to aerial survey dose rates.

Figure A-XVI, Transmission Factors/Protection Factors

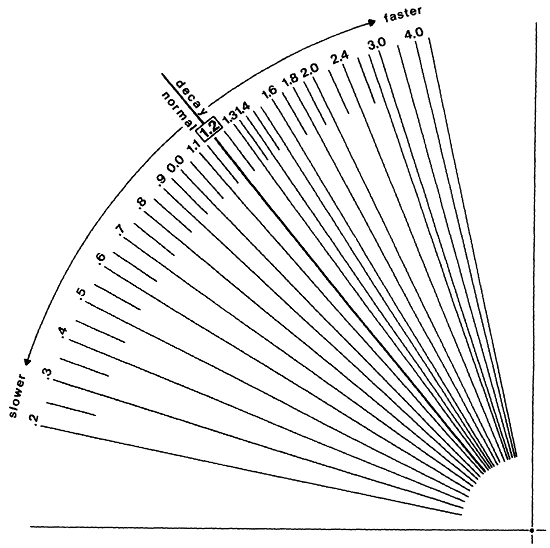


Figure A-XVII, Overlay for Determination of Decay Rate.

Normalising factors (Correction to H + 1 hour).								
TIME AFTER BURST	DECAY EXPONENT (n)							
	0.600	0.800	1.000	1.200	1.400	1.600	1.800	2.000
10 min	0.341	0.238	0.167	0.116	0.081	0.057	0.040	0.028
20 min	0.517	0.415	0.333	0.268	0.215	0.172	0.138	0.111
30 min	0.660	0.574	0.500	0.435	0.379	0.330	0.287	0.250
40 min	0.784	0.723	0.667	0.615	0.567	0.523	0.482	0.444
50 min	0.896	0.864	0.833	0.803	0.775	0.747	0.720	0.694
1 hr 0 min	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
1 hr 10 min	1.090	1.130	1.160	1.200	1.240	1.280	1.320	1.360
1 hr 20 min	1.180	1.250	1.330	1.410	1.490	1.580	1.670	1.770
1 hr 30 min	1.270	1.380	1.500	1.620	1.760	1.910	2.070	2.250
1 hr 40 min	1.350	1.500	1.660	1.840	2.040	2.260	2.500	2.770
1 hr 50 min	1.430	1.620	1.830	2.070	2.330	2.630	2.970	3.360
2 hr 0 min	1.510	1.740	2.000	2.290	2.630	3.030	3.480	4.000
2 hr 15 min	1.620	1.910	2.250	2.640	3.110	3.660	4.300	5.060
2 hr 30 min	1.730	2.080	2.500	3.000	3.600	4.330	5.200	6.250
2 hr 45 min	1.830	2.240	2.750	3.360	4.120	5.040	6.170	7.560
3 hr 0 min	1.930	2.400	3.000	3.730	4.650	5.800	7.220	9.000
3 hr 15 min	2.020	2.560	3.250	4.110	5.200	6.590	8.340	10.560
3 hr 30 min	2.120	2.720	3.500	4.490	5.770	7.420	9.530	12.250
3 hr 45 min	2.210	2.870	3.750	4.880	6.360	8.280	10.790	14.060
4 hr 0 min	2.290	3.030	4.000	5.270	6.960	9.190	12.120	16.000
4 hr 20 min	2.410	3.230	4.330	5.810	7.790	10.440	14.000	18.770
4 hr 40 min	2.520	3.420	4.660	6.350	8.640	11.760	16.000	21.770
5 hr 0 min	2.620	3.620	5.000	6.890	9.510	13.130	18.110	25.000
5 hr 20 min	2.730	3.810	5.330	7.450	10.410	14.560	20.350	28.440
5 hr 40 min	2.830	4.000	5.660	8.010	11.340	16.040	22.690	32.110
6 hr 0 min	2.930	4.190	6.000	8.580	12.280	17.580	25.150	36.000
6 hr 20 min	3.020	4.370	6.330	9.160	13.250	19.170	27.720	40.110
6 hr 40 min	3.120	4.560	6.660	9.740	14.230	20.800	30.410	44.440
7 hr 0 min	3.210	4.740	7.000	10.330	15.240	22.490	33.200	49.000
7 hr 20 min	3.300	4.920	7.330	10.920	16.270	24.230	36.100	53.770
7 hr 40 min	3.390	5.100	7.660	11.520	17.310	26.020	39.110	58.770
8 hr 0 min	3.480	5.270	8.000	12.120	18.370	27.850	42.220	64.000
9 hr 0 min	3.730	5.800	9.000	13.960	21.670	33.630	52.190	81.000
10 hr 0 min	3.980	6.310	10.000	15.840	25.110	39.810	63.090	100.000
11 hr 0 min	4.210	6.800	11.000	17.760	28.700	46.360	74.900	121.000
12 hr 0 min	4.440	7.300	12.000	19.720	32.420	53.290	87.600	144.000

Figure A-XVIII, Normalising Factors (Correction to H + 1 hour).

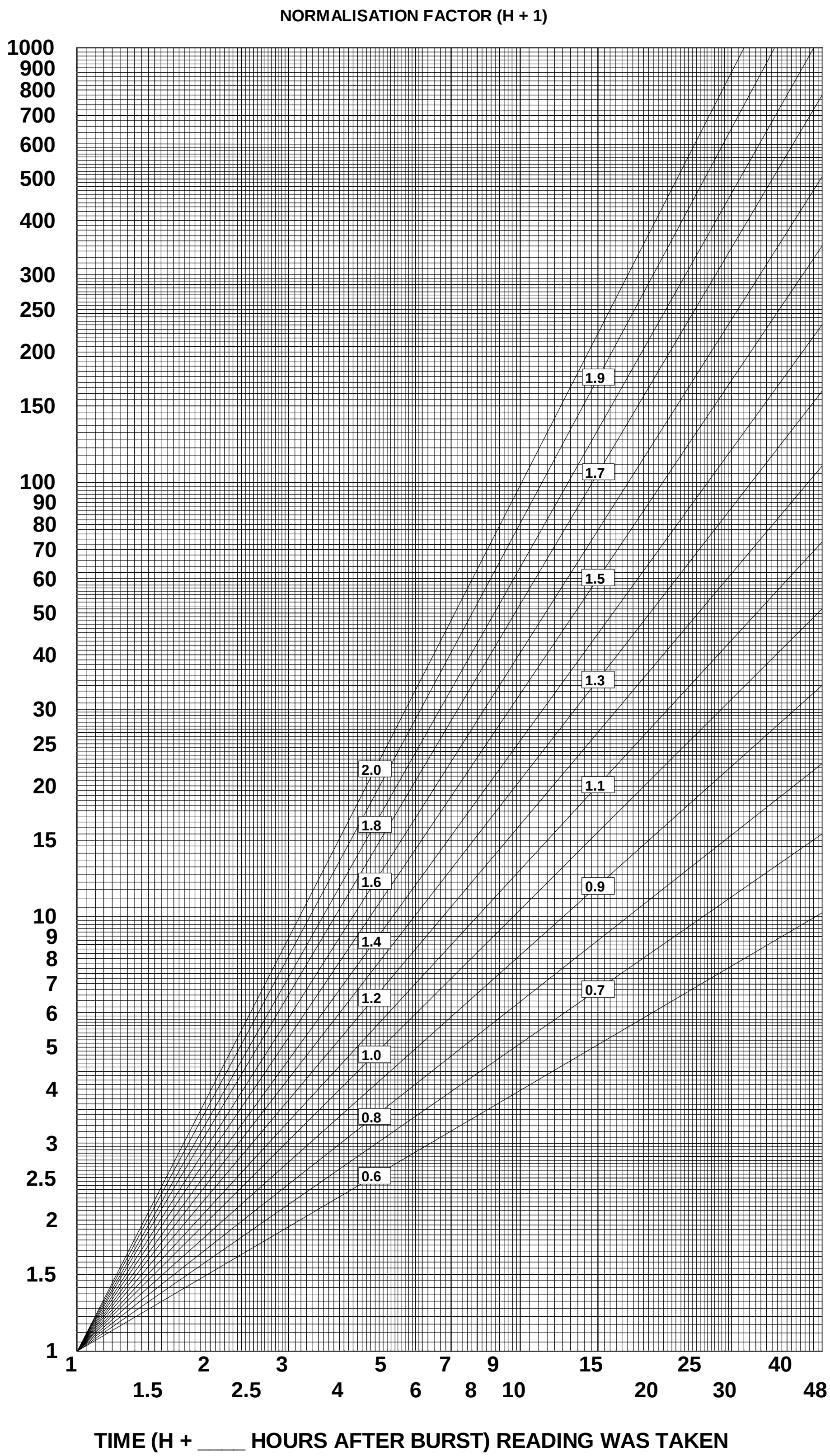


Figure A-XIX(a), Graphical Method for Determining Normalisation Factor.

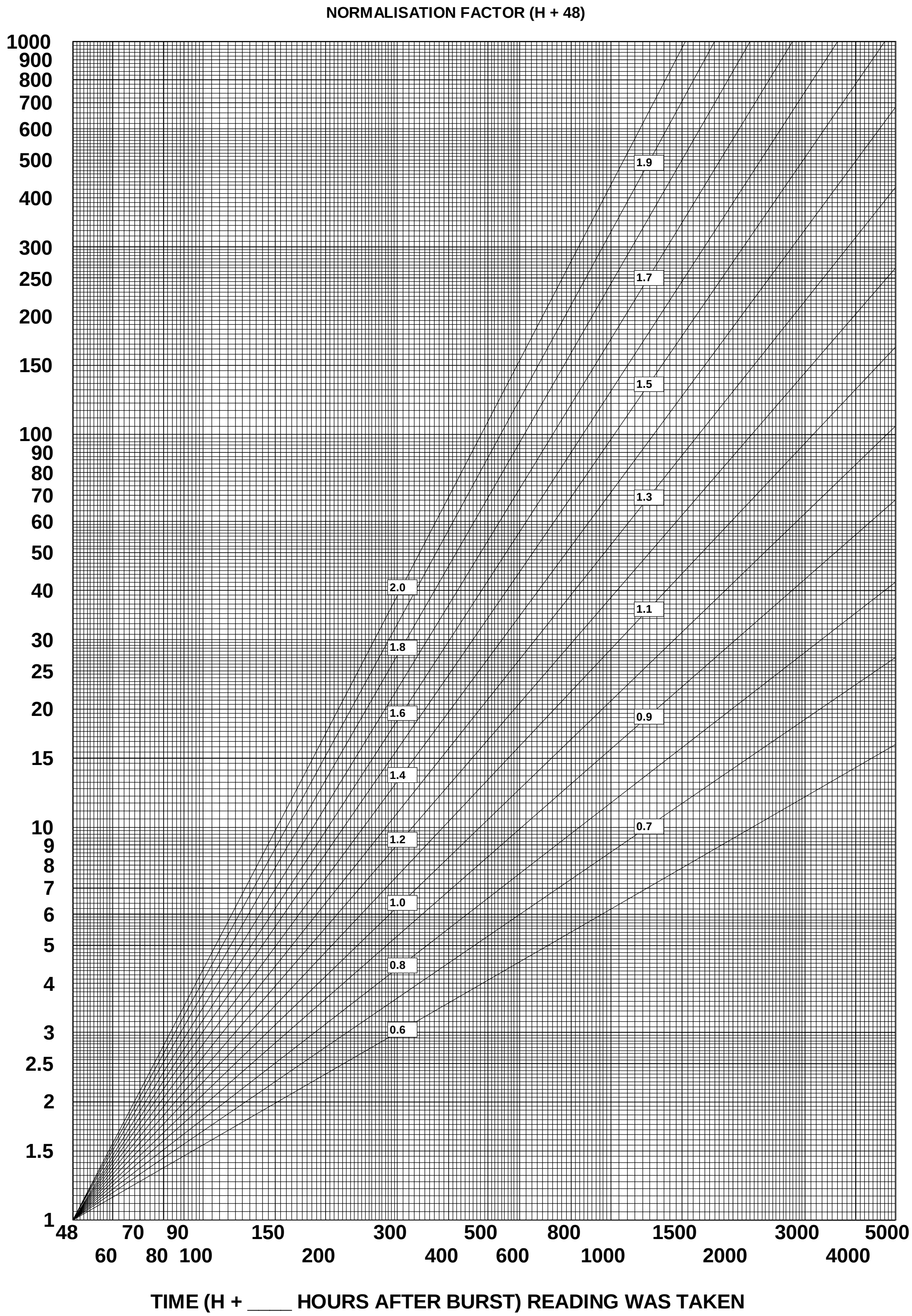


Figure A-XIX(b), Graphical Method for Determining Normalisation Factor.

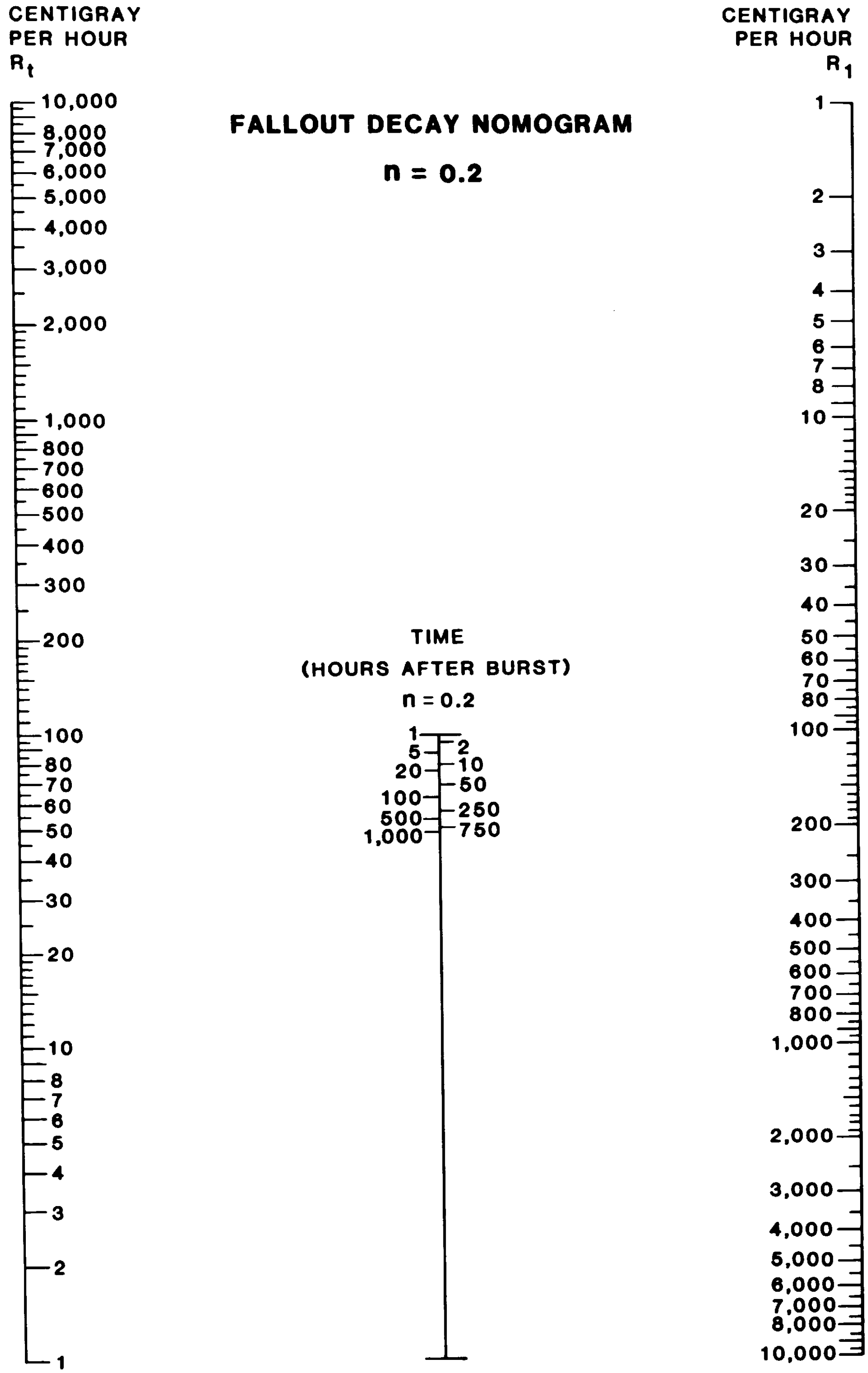

CENTIGRAY
PER HOUR
R t
10,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
800
700
600
500
400
300
200
100
80
70
60
50
40
30
20
10
8
7
6
5
4
3
2
1
FALLOUT DECAY NOMOGRAM
n = 0.2
TIME
(HOURS AFTER BURST)
n = 0.2
1
2
5
10
20
50
100
250
500
750
1,000
CENTIGRAY
PER HOUR
R 1
1
2
3
4
5
6
7
8
10
20
30
40
50
60
70
80
100
200
300
400
500
600
700
800
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
10,000

Figure A-XX

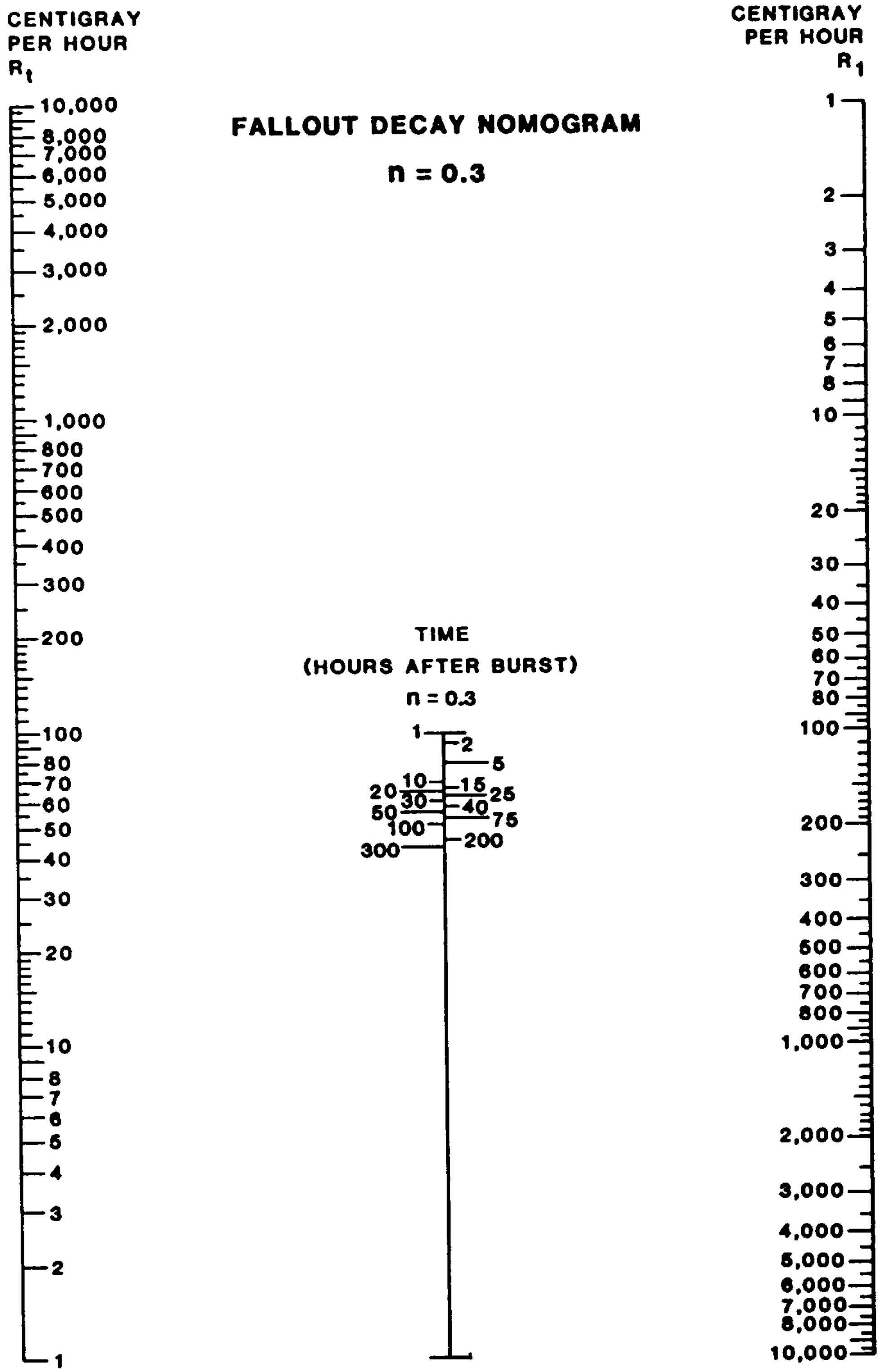

CENTIGRAY
PER HOUR
R_t
10,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
800
700
600
500
400
300
200
100
80
70
60
50
40
30
20
10
8
7
6
5
4
3
2
1
FALLOUT DECAY NOMOGRAM
n = 0.3
TIME
(HOURS AFTER BURST)
n = 0.3
1
2
5
10
15
20
25
30
40
50
75
100
200
300
CENTIGRAY
PER HOUR
R_1
1
2
3
4
5
6
7
8
10
20
30
40
50
60
70
80
100
200
300
400
500
600
700
800
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
10,000

Figure A-XXI

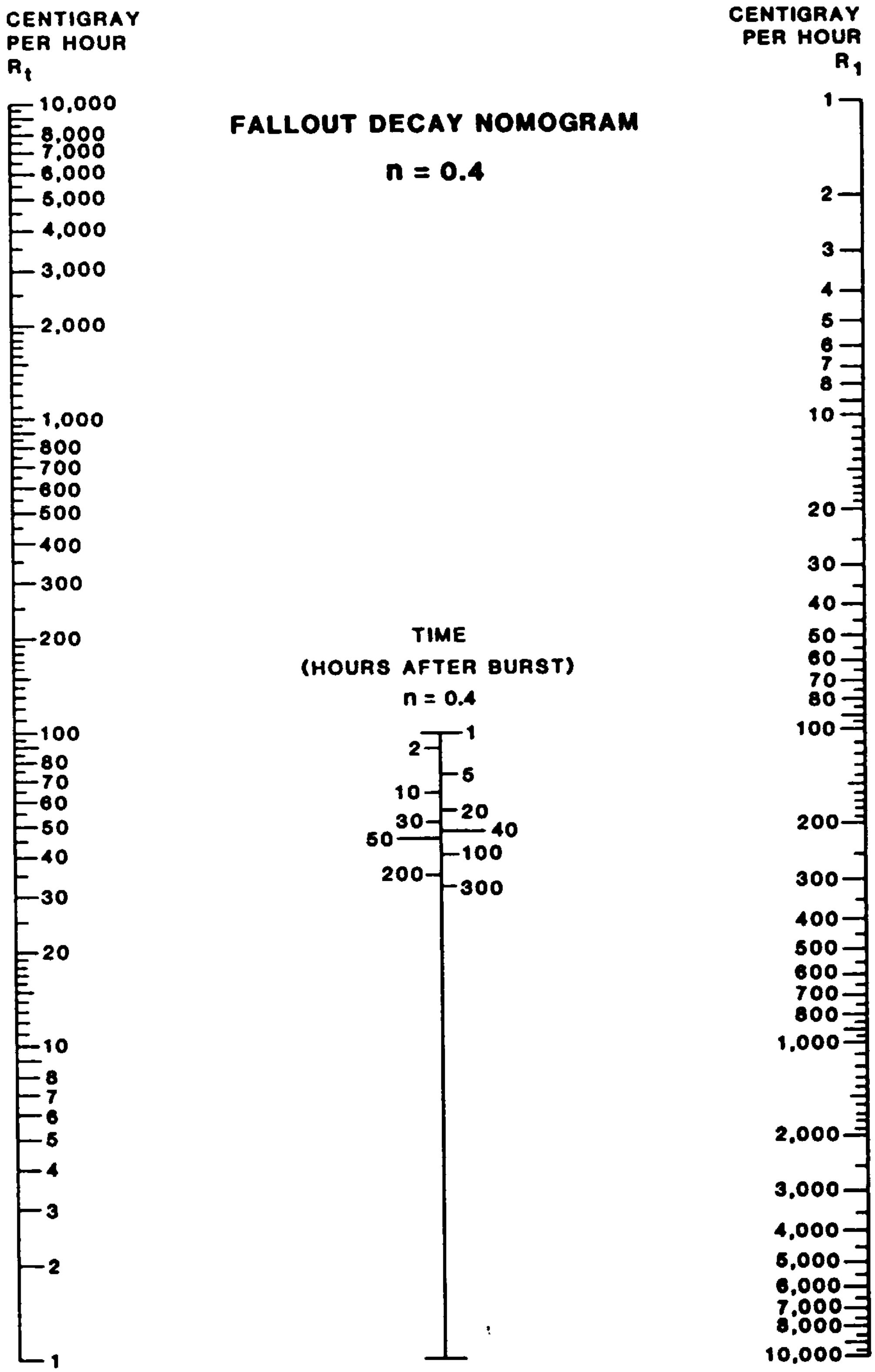


Figure A-XXII

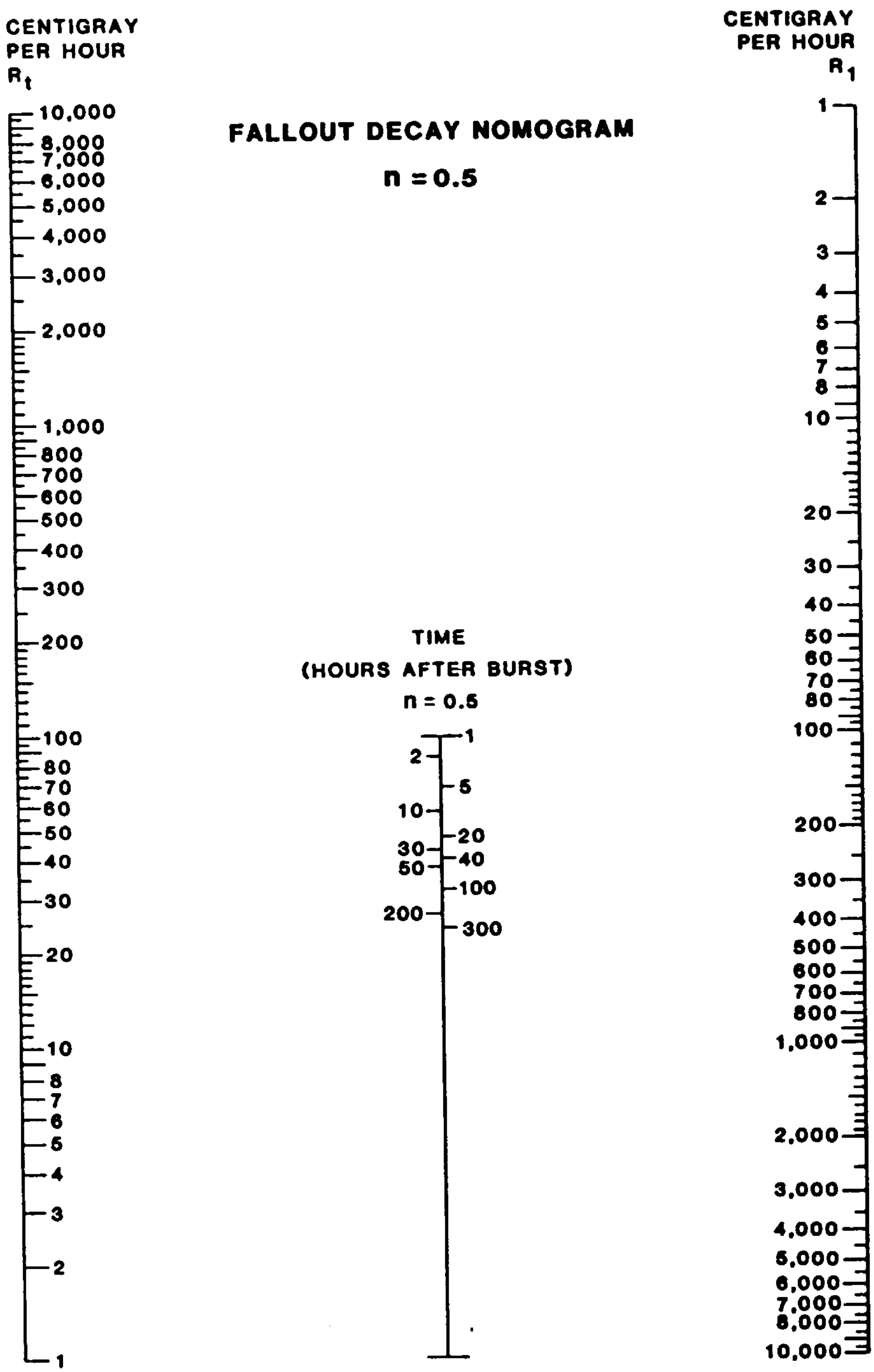


Figure A-XXIII

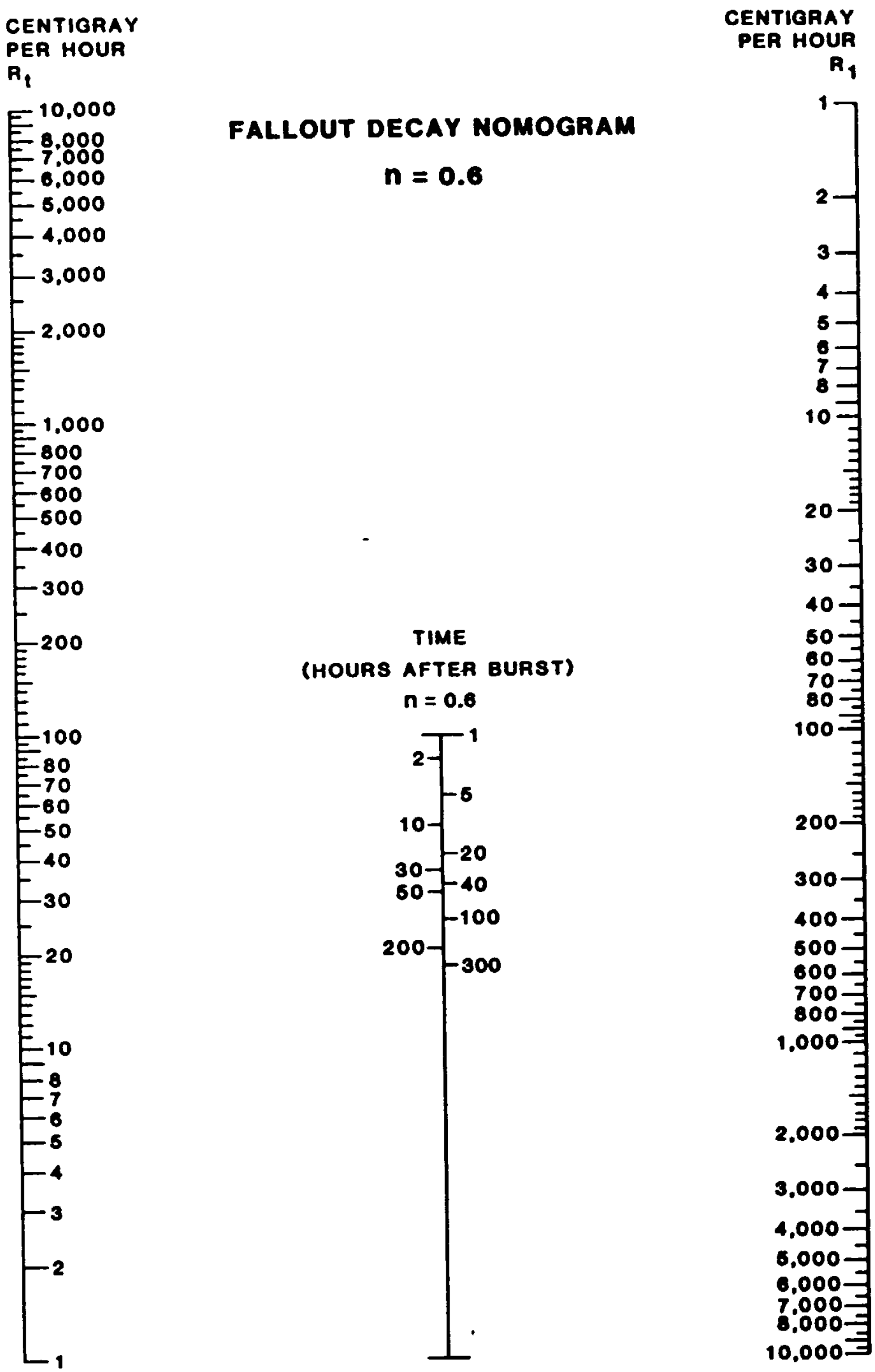


Figure A-XXIV

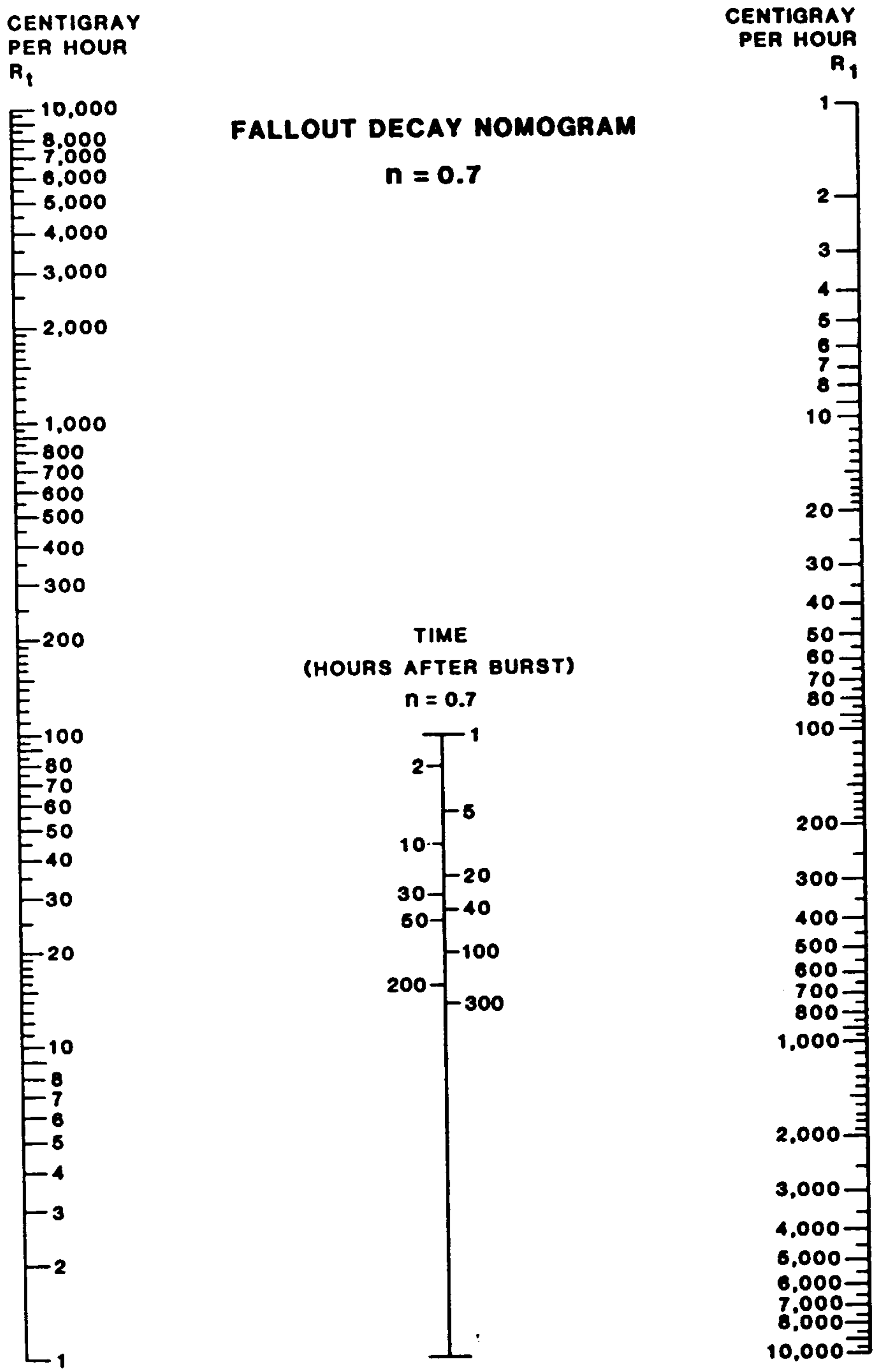

CENTIGRAY PER HOUR R_t
10,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
800
700
600
500
400
300
200
100
80
70
60
50
40
30
20
10
8
7
6
5
4
3
2
1
FALLOUT DECAY NOMOGRAM
n = 0.7
TIME
(HOURS AFTER BURST)
n = 0.7
1
2
5
10
20
30
40
50
100
200
300
CENTIGRAY PER HOUR R_1
1
2
3
4
5
6
7
8
10
20
30
40
50
60
70
80
100
200
300
400
500
600
700
800
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
10,000

Figure A-XXV

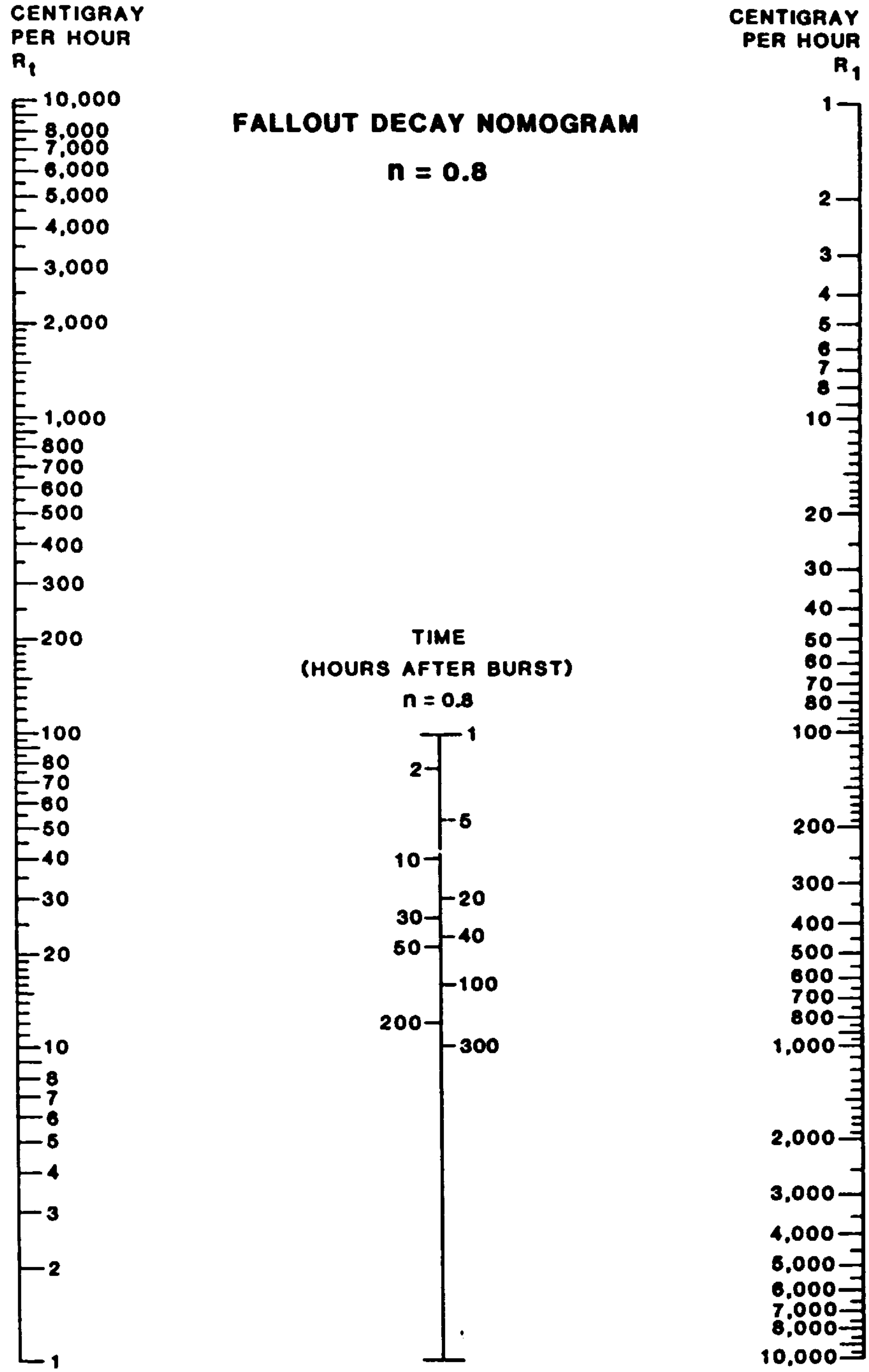


Figure A-XXVI

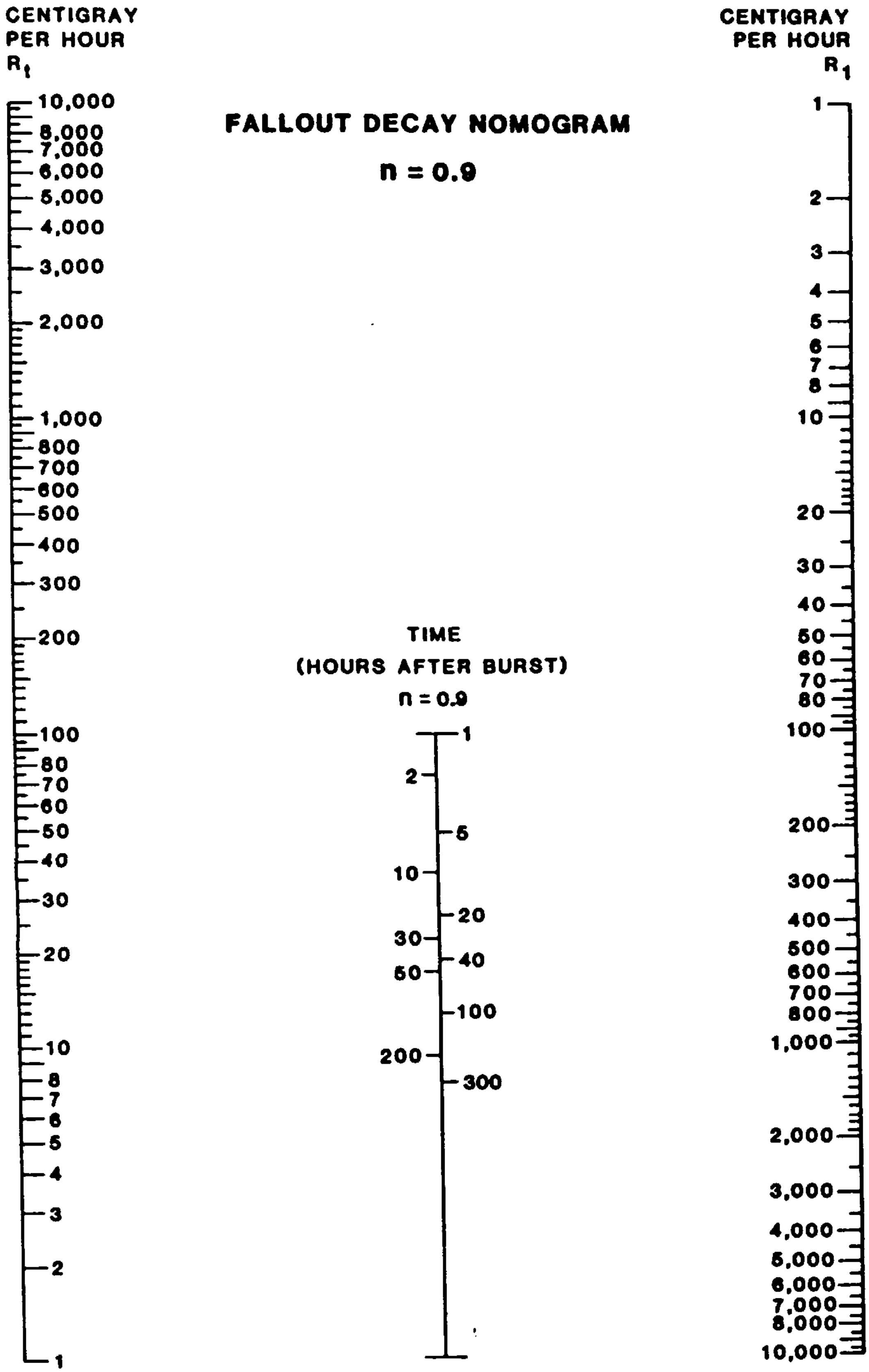


Figure A-XXVII

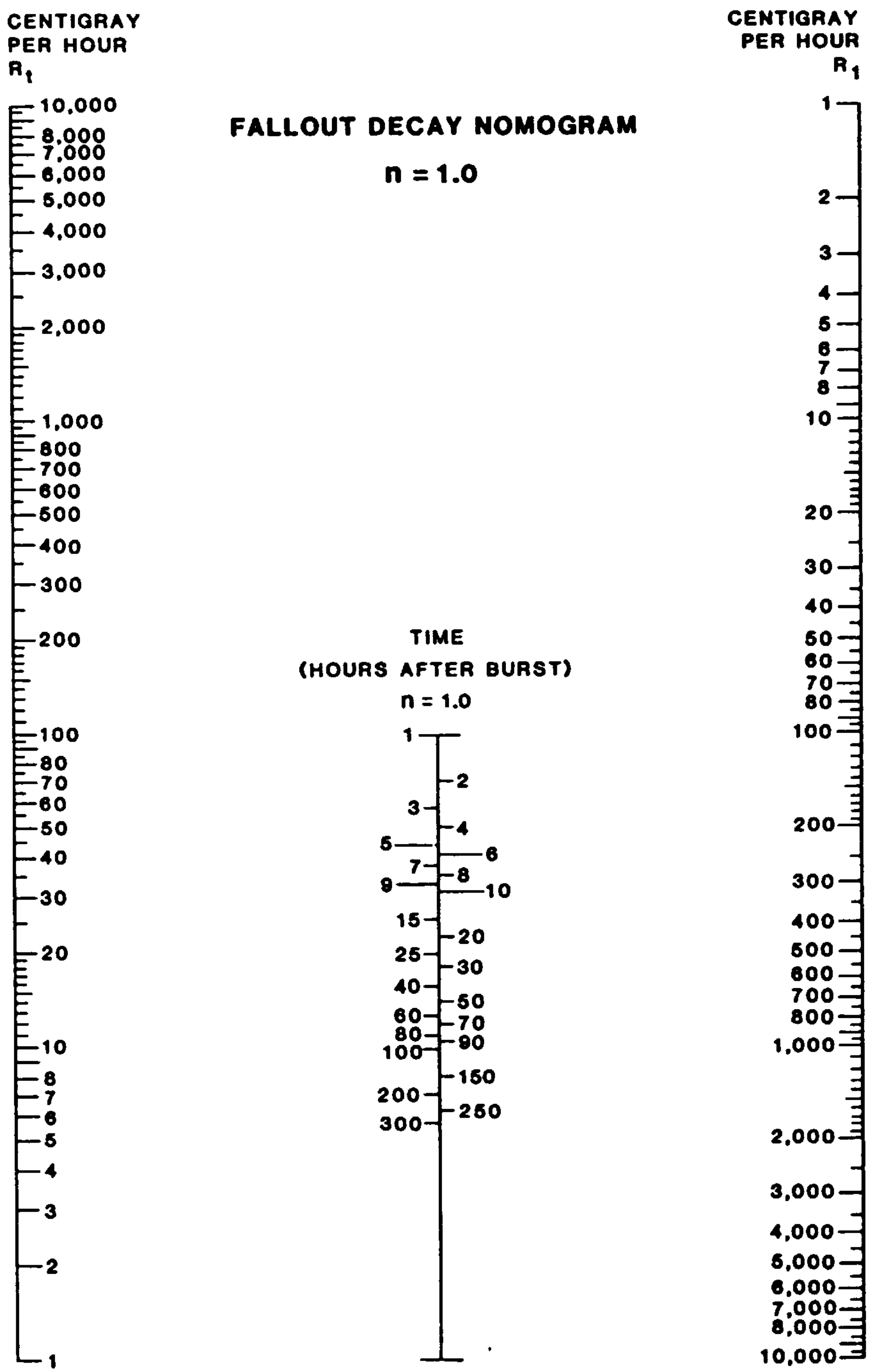


Figure A-XXVIII

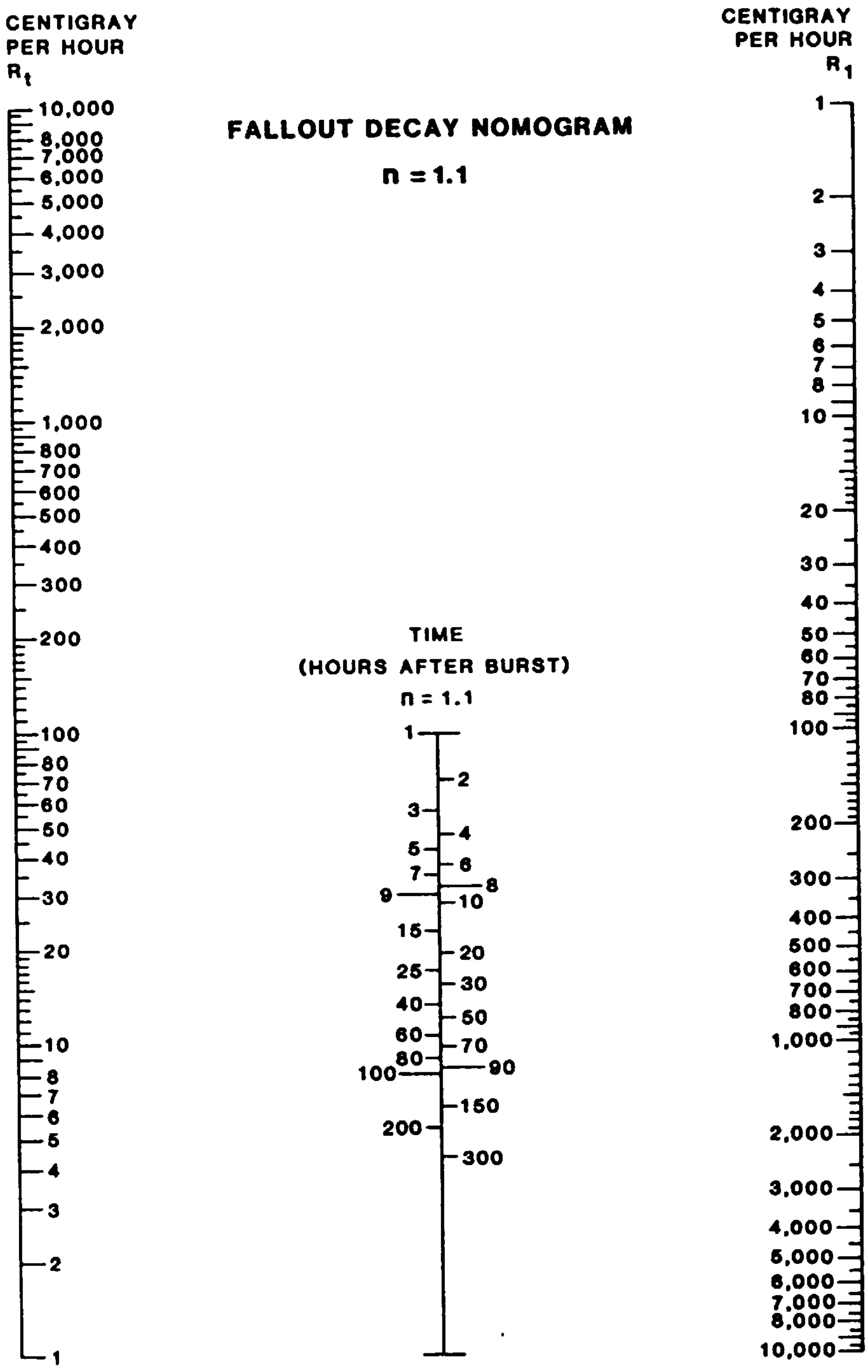


Figure A-XXIX

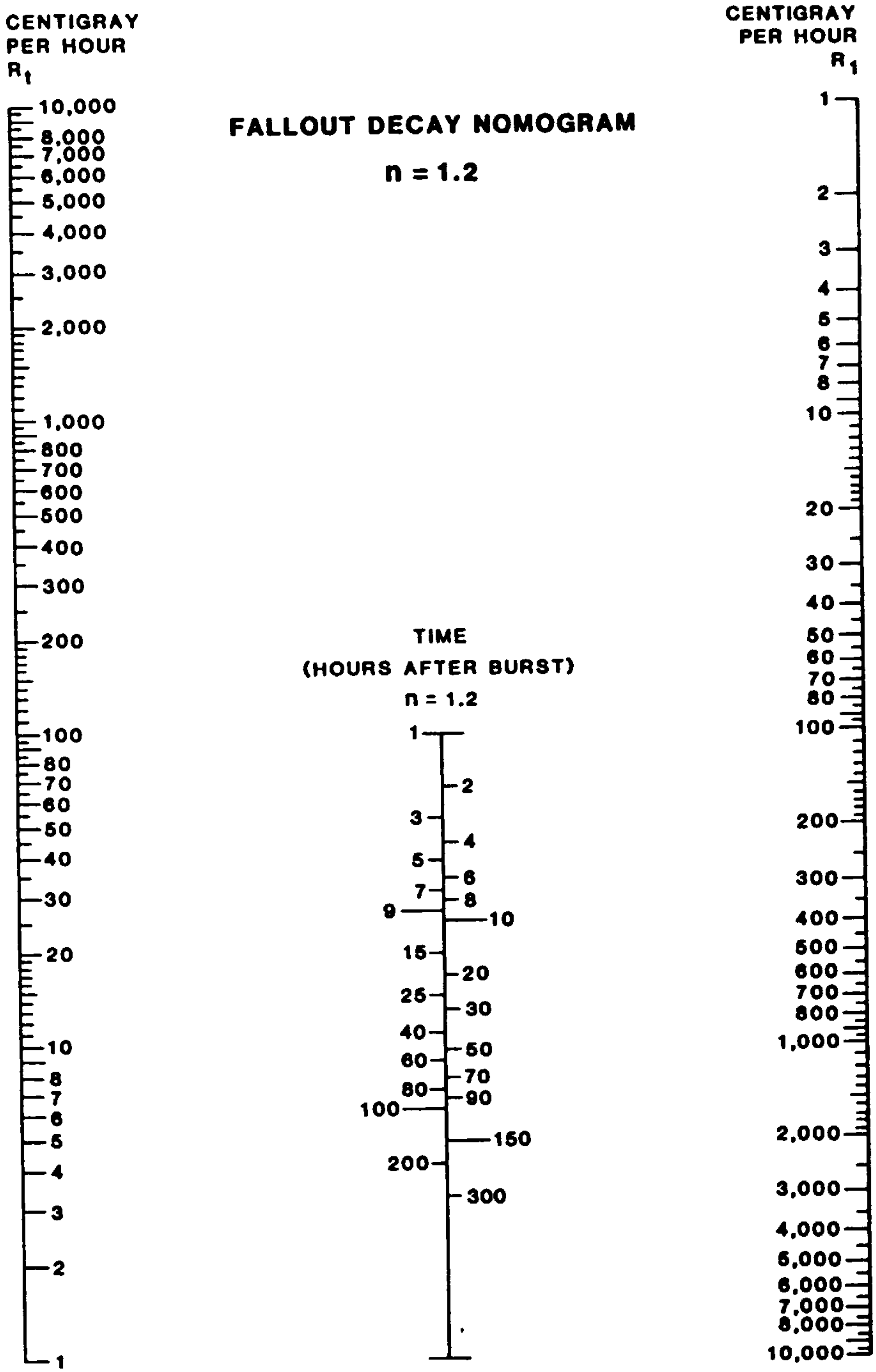

CENTIGRAY
PER HOUR
R_t
10,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
800
700
600
500
400
300
200
100
80
70
60
50
40
30
20
10
8
7
6
5
4
3
2
1
FALLOUT DECAY NOMOGRAM
n = 1.2
TIME
(HOURS AFTER BURST)
n = 1.2
1
2
3
4
5
6
7
8
9
10
15
20
25
30
40
50
60
70
80
90
100
150
200
300
CENTIGRAY
PER HOUR
R_1
1
2
3
4
5
6
7
8
10
20
30
40
50
60
70
80
100
200
300
400
500
600
700
800
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
10,000

Figure A-XXX

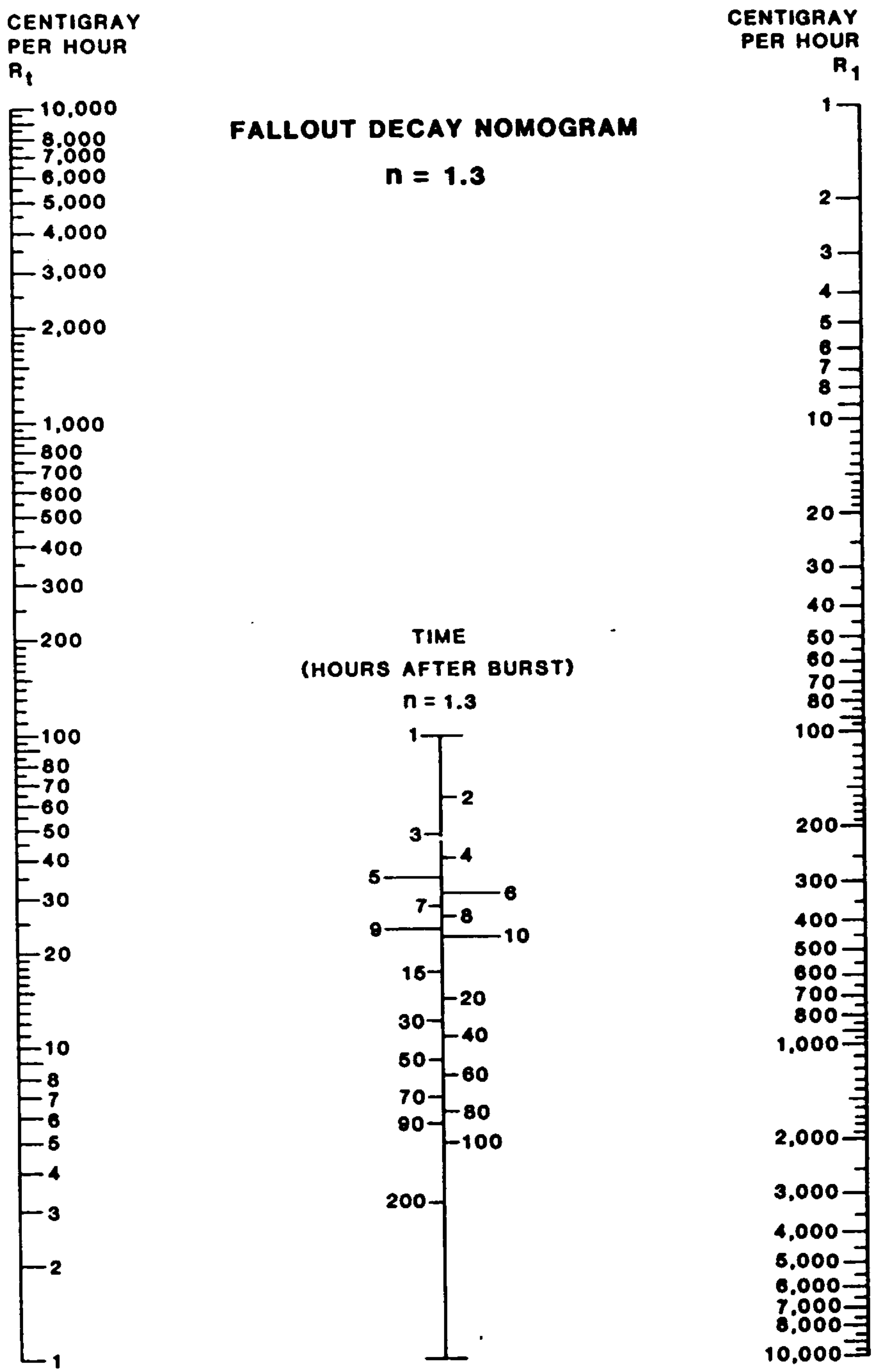


Figure A-XXXI

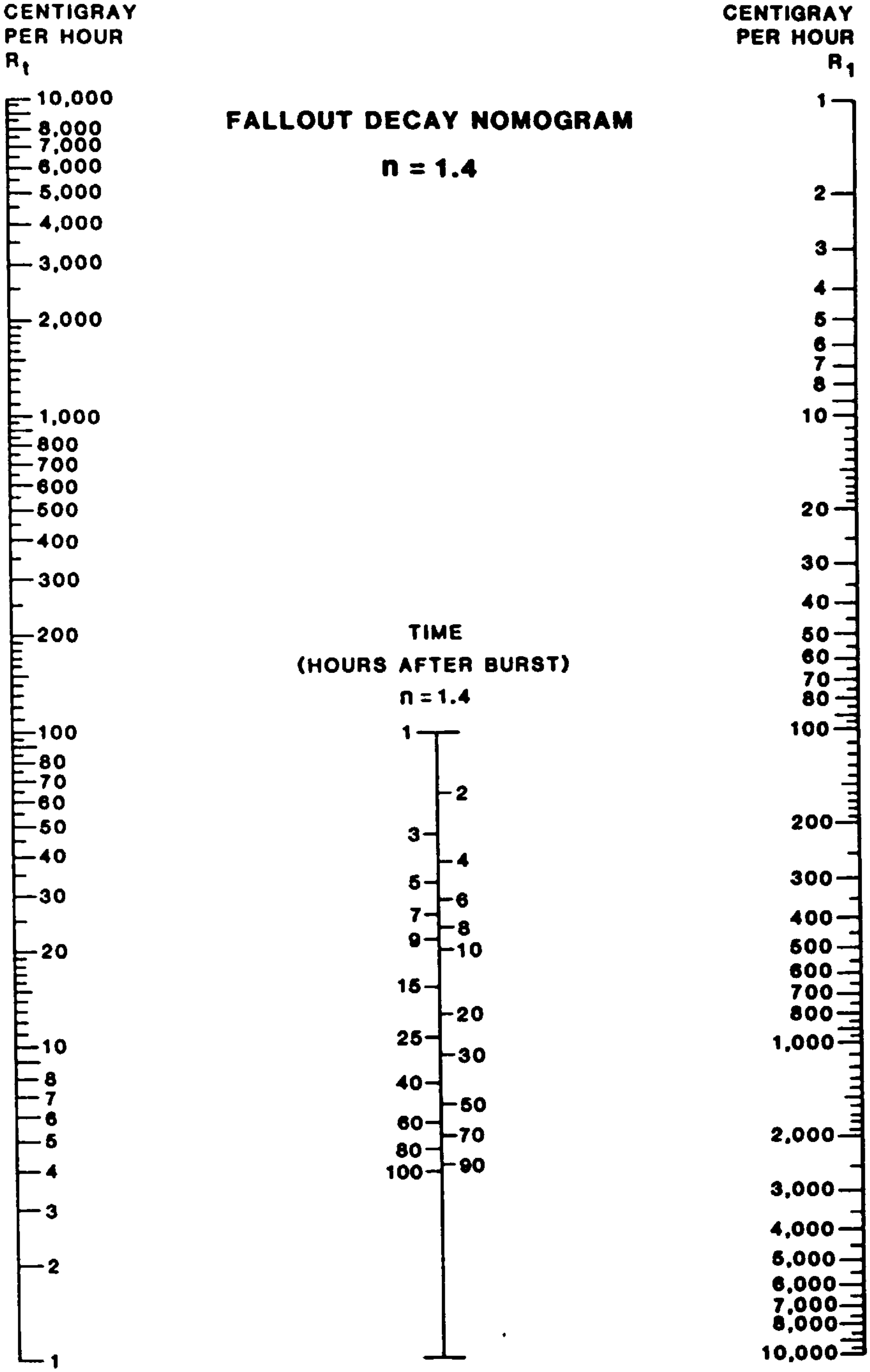


Figure A-XXXII

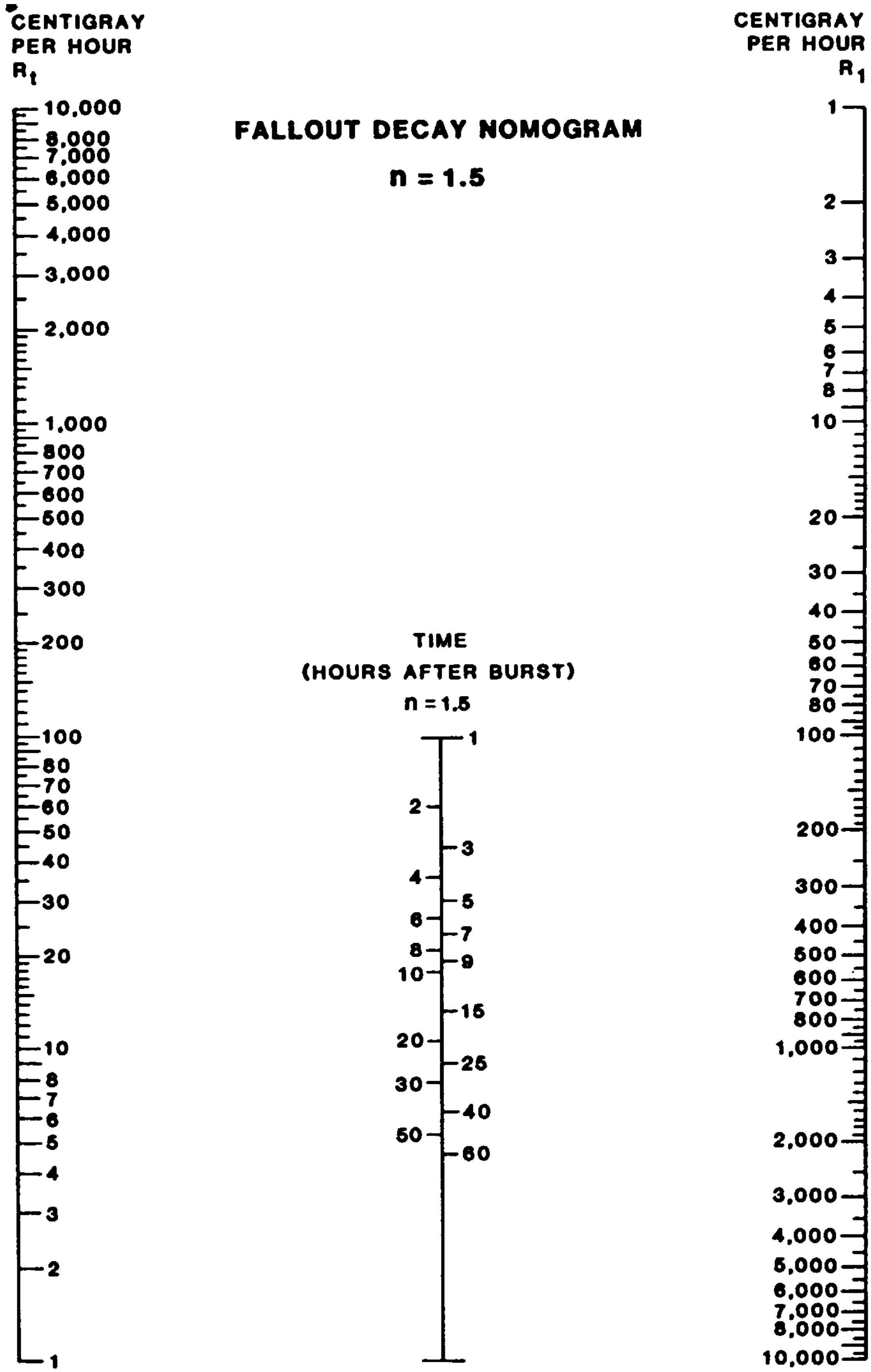


Figure A-XXXIII

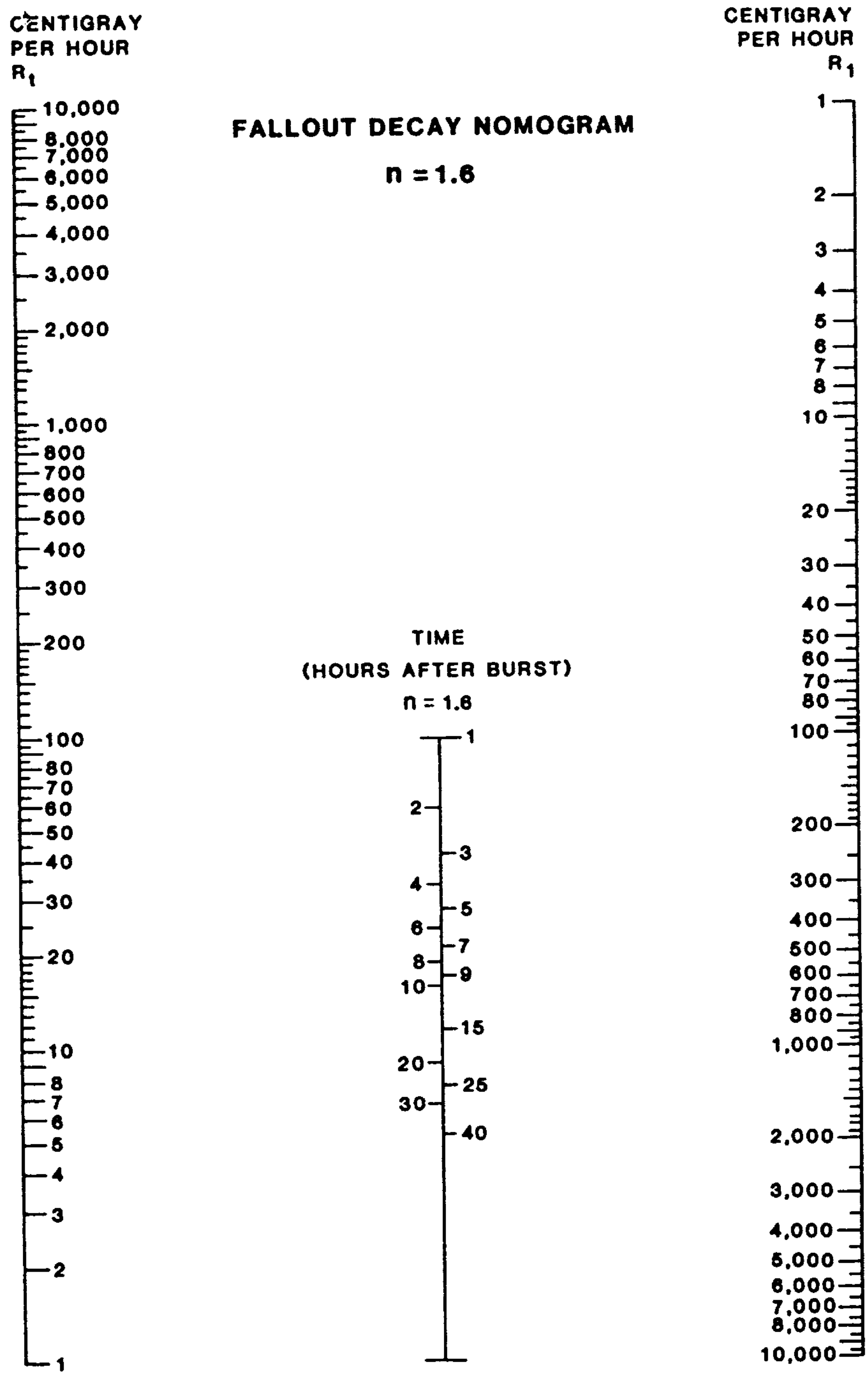


Figure A-XXXIV

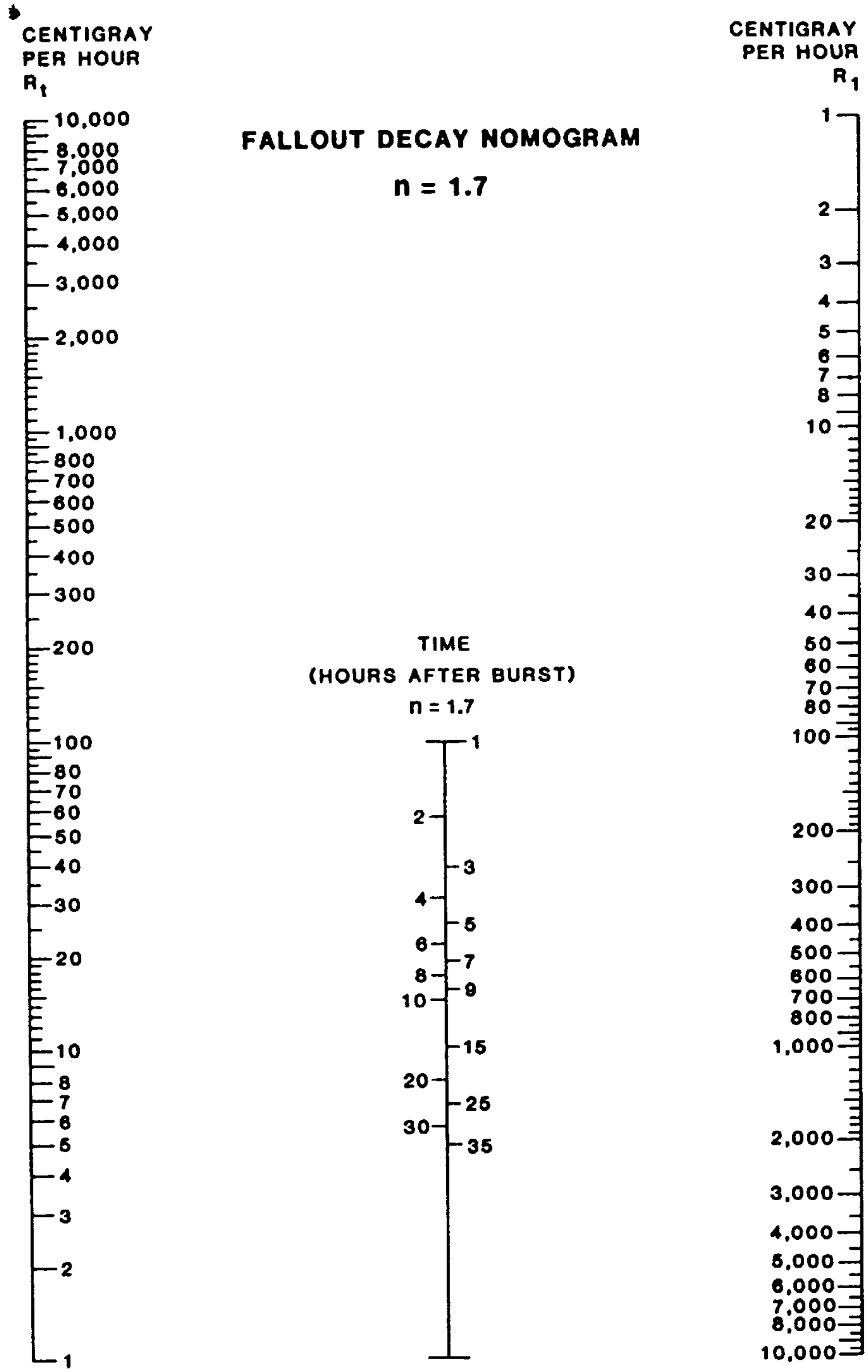


Figure A-XXXV

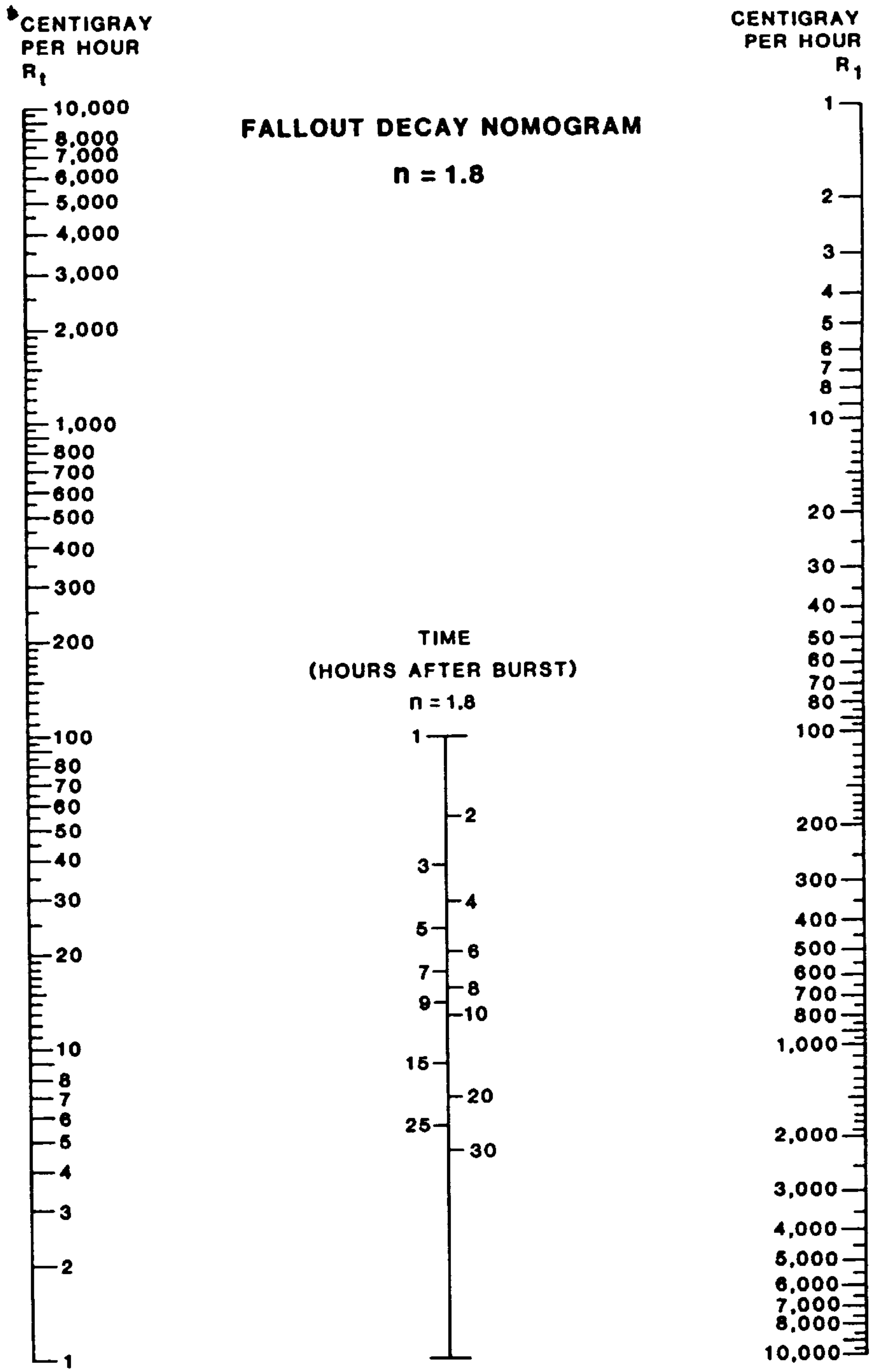


Figure A-XXXVI

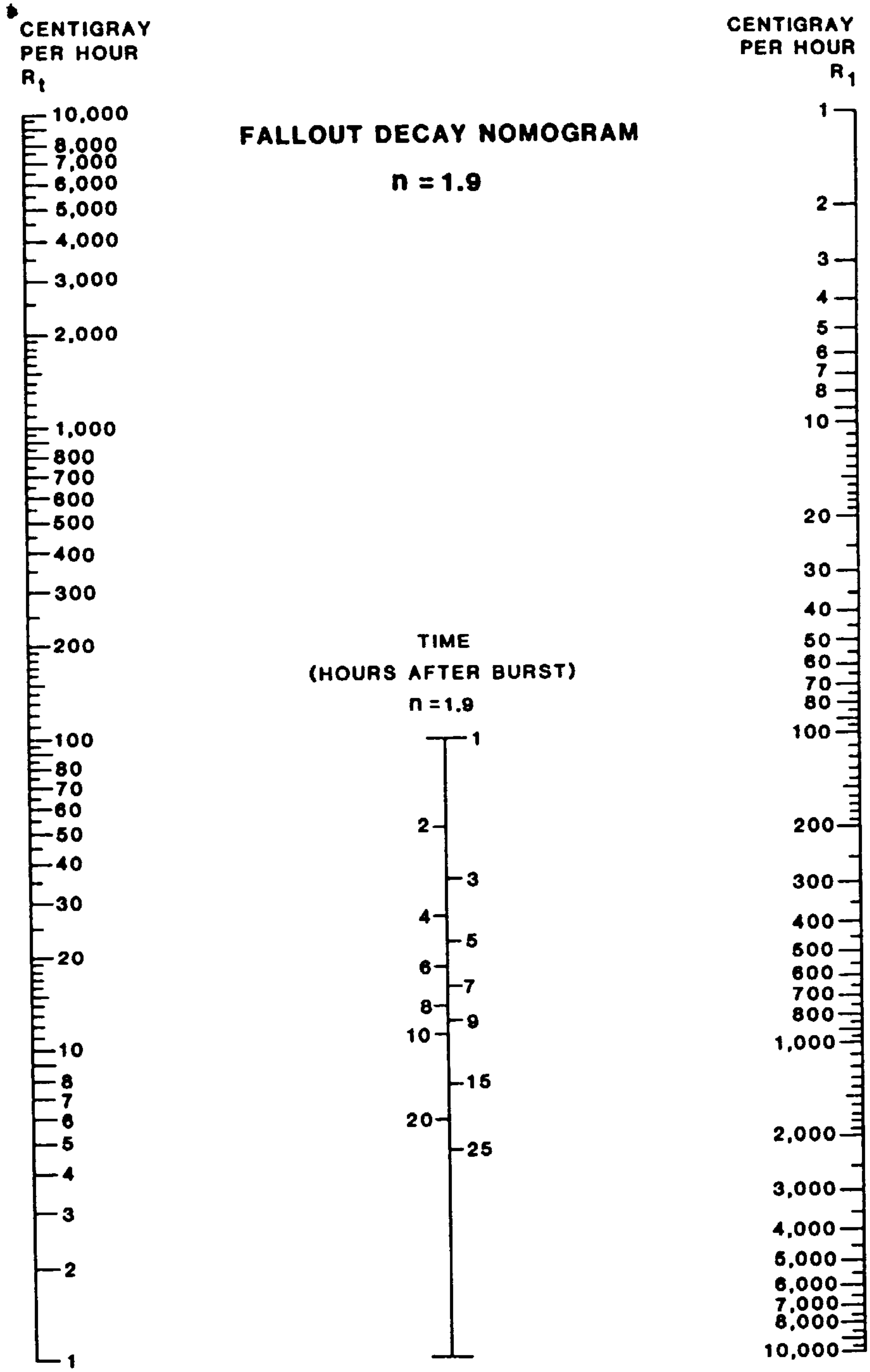


Figure A-XXXVII

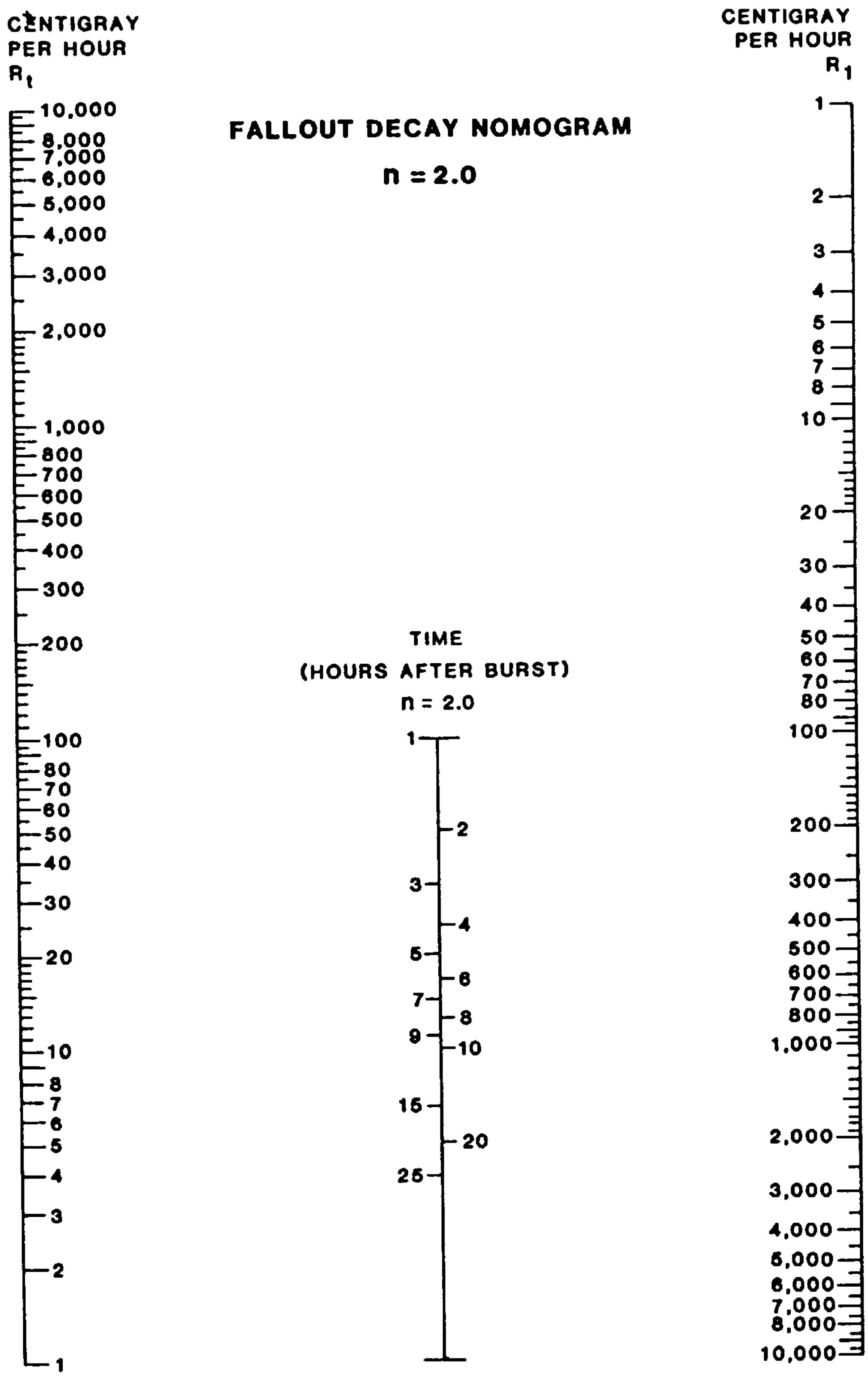


Figure A-XXXVIII

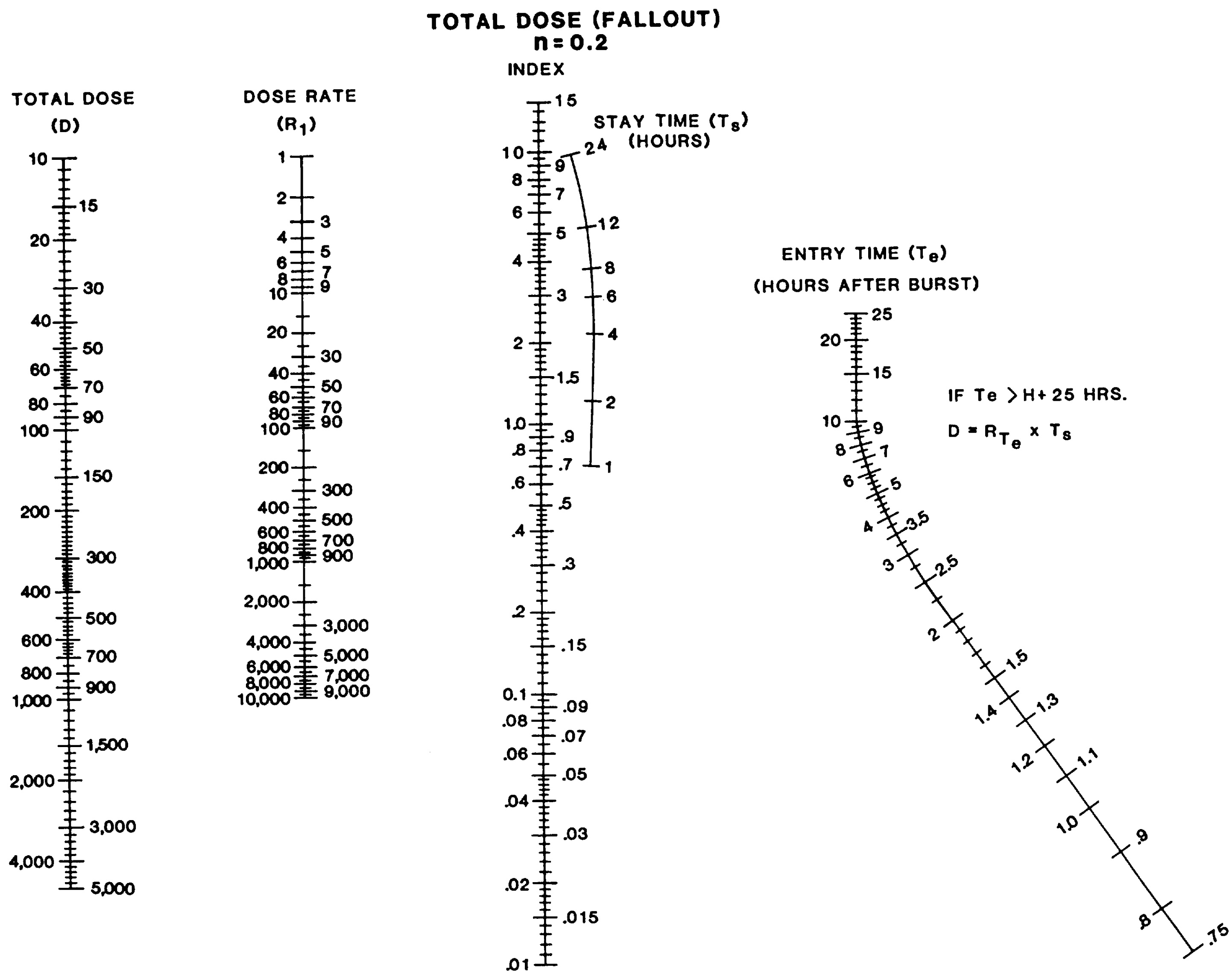


Figure A-XXXIX

NATO/PfP UNCLASSIFIED

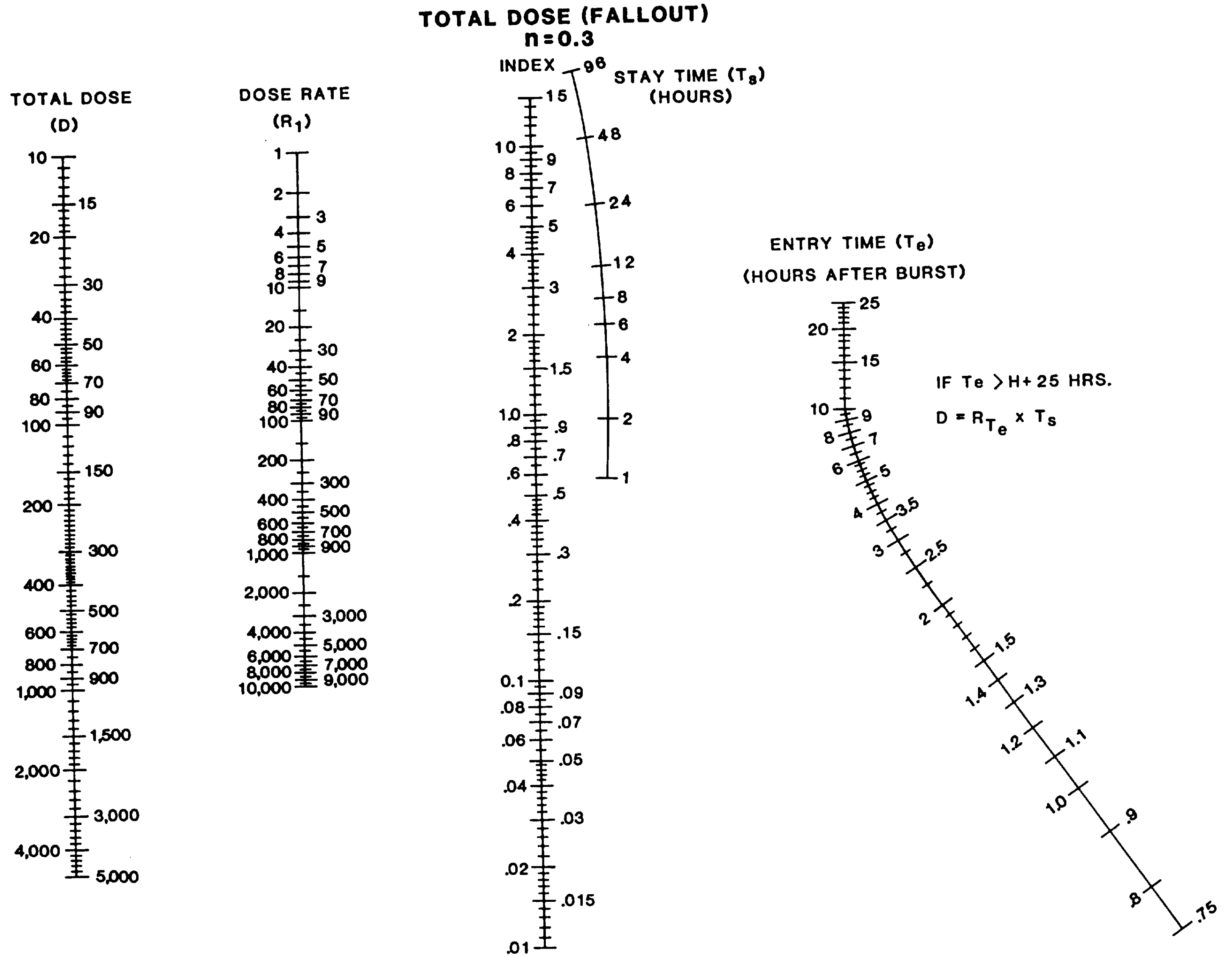
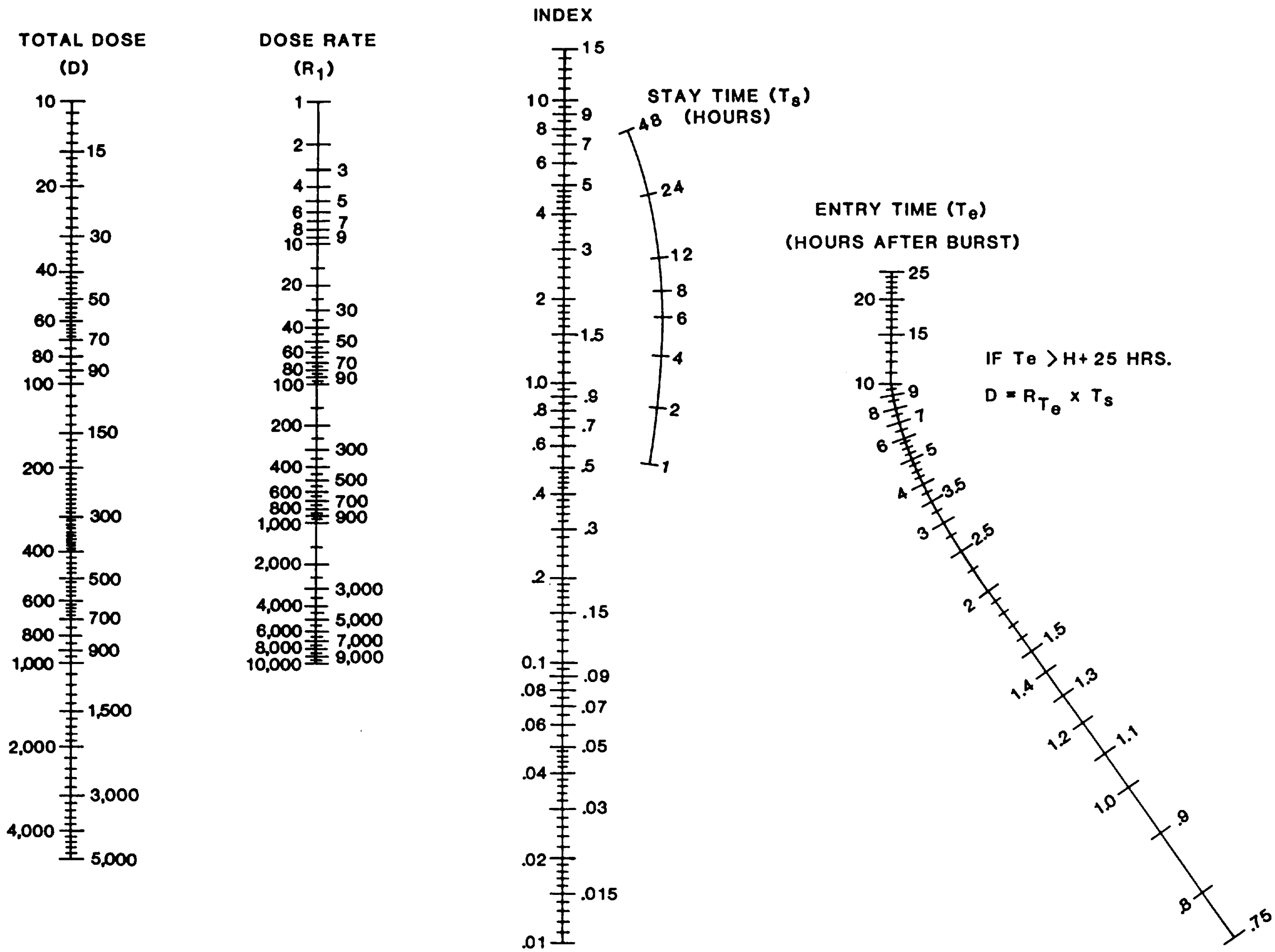

TOTAL DOSE (FALLOUT)
n=0.3
TOTAL DOSE
(D)
DOSE RATE
(R_1)
INDEX
STAY TIME (T_s)
(HOURS)
ENTRY TIME (T_e)
(HOURS AFTER BURST)
IF Te > H+25 HRS.
D = R_{T_e} x T_s

Figure A-XL

A-XLI

TOTAL DOSE (FALLOUT)
n=0.4



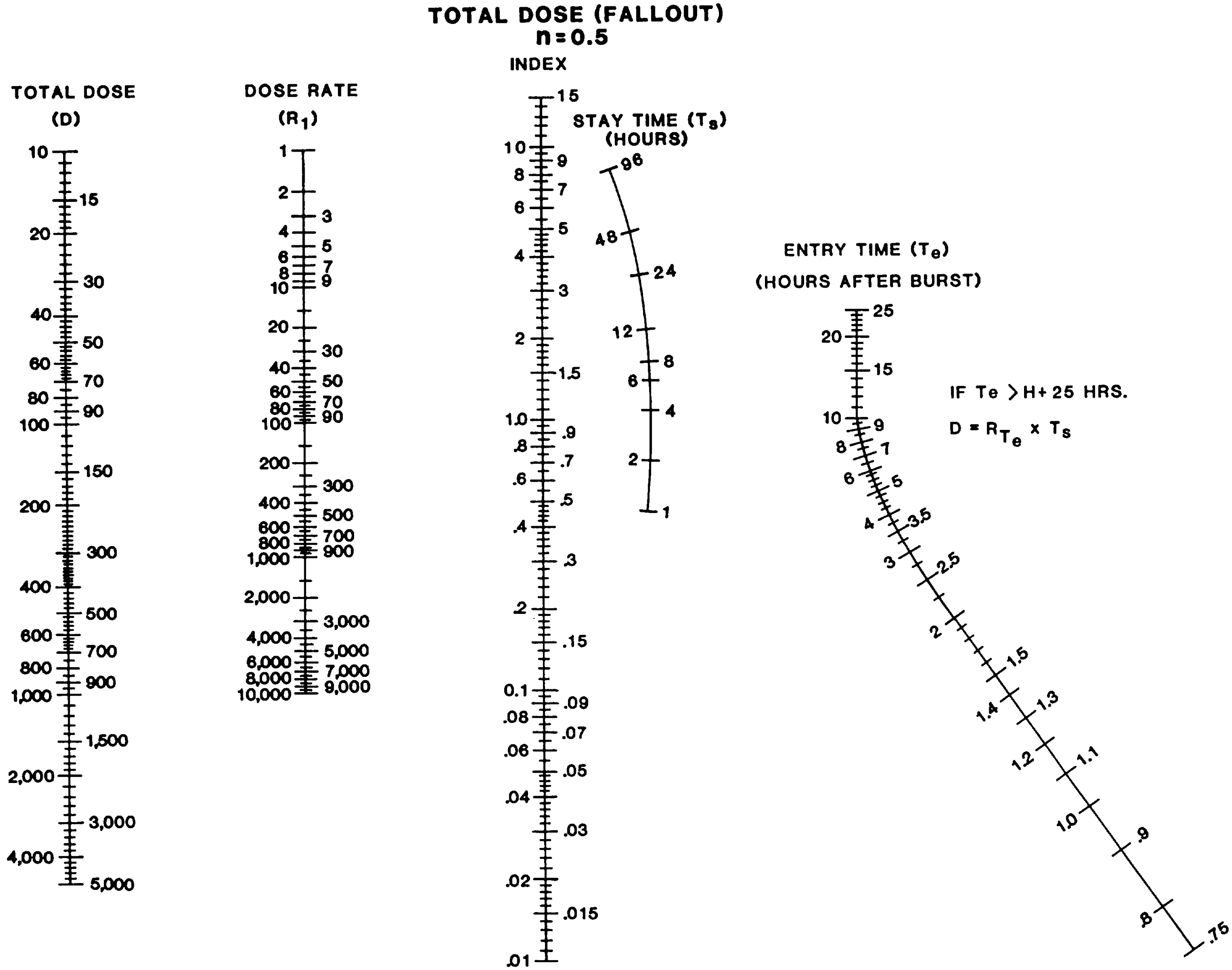


Figure A-XLII

ATP-45(C)

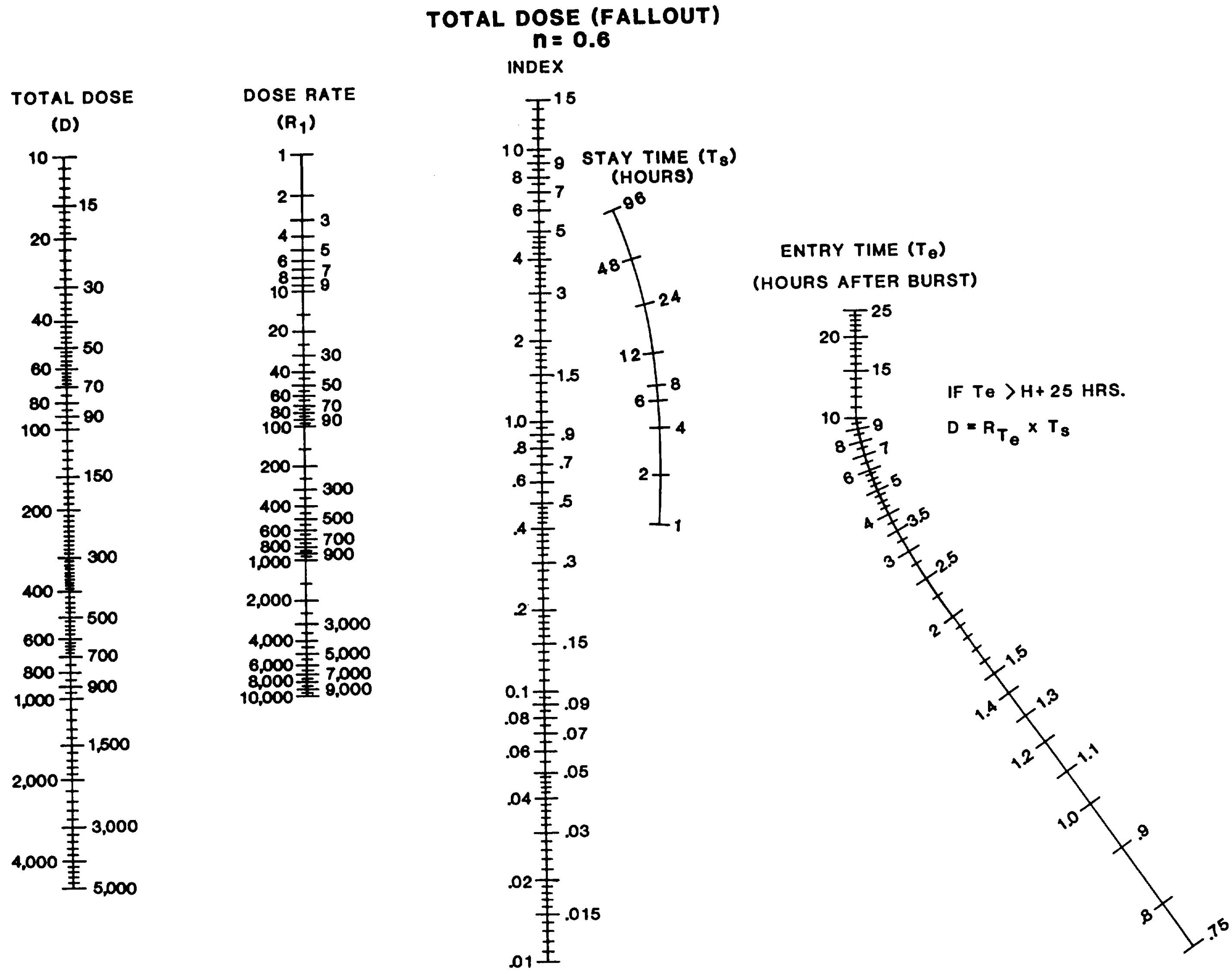


Figure A-XLIII

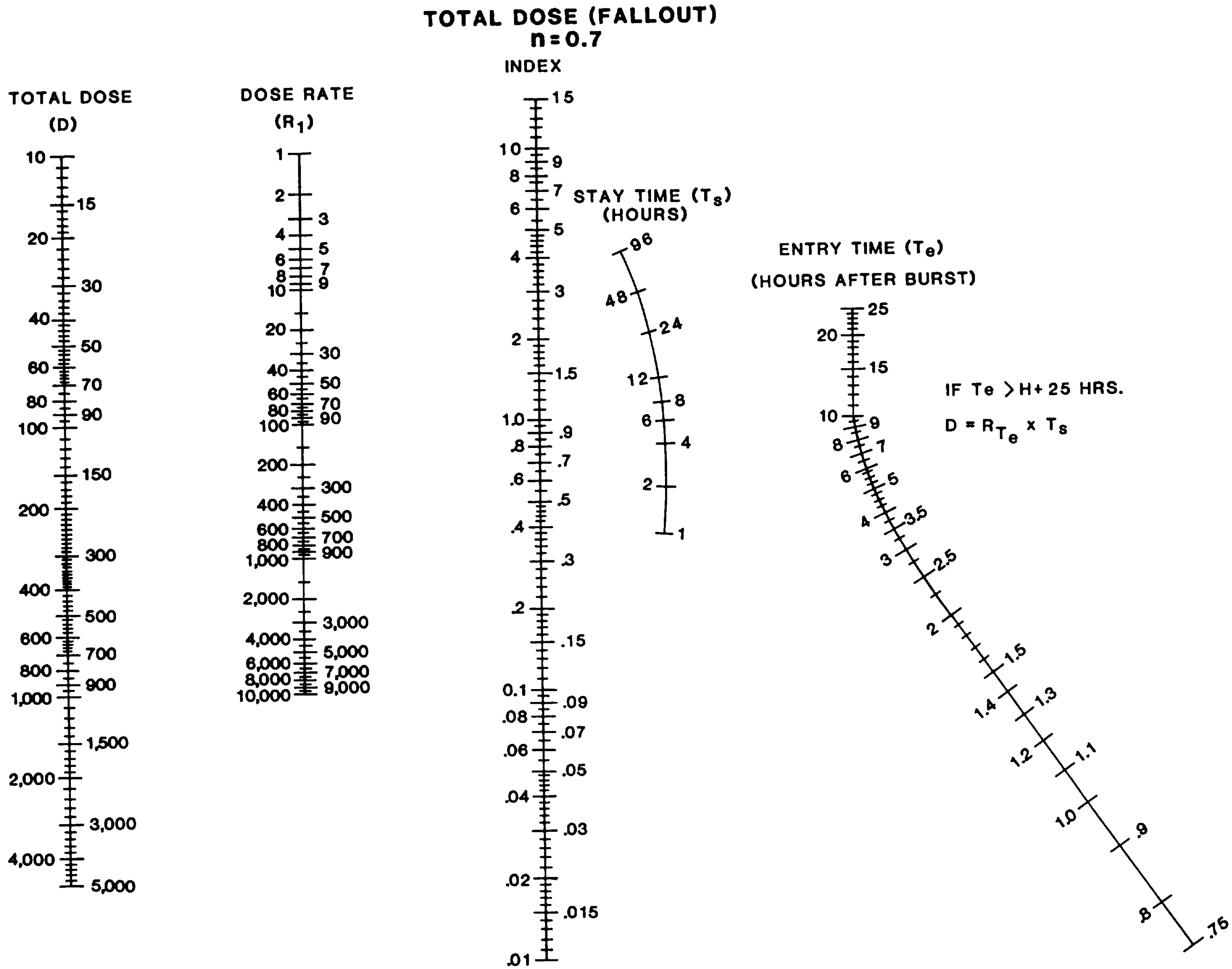


Figure A-XLIV

NATO/PfP UNCLASSIFIED

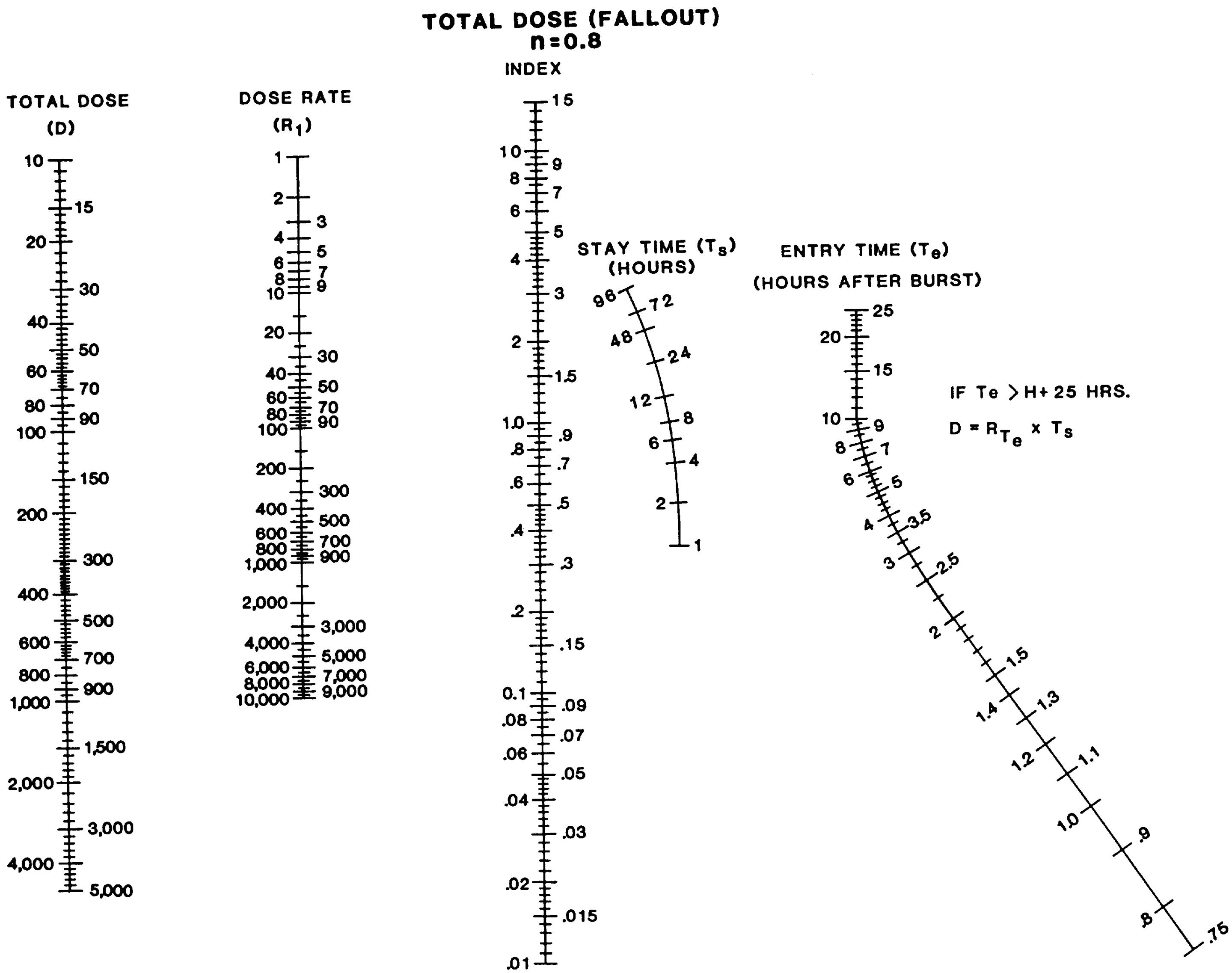

TOTAL DOSE (FALLOUT)
n=0.8
TOTAL DOSE
(D)
DOSE RATE
(R_1)
INDEX
STAY TIME (T_s)
(HOURS)
ENTRY TIME (T_e)
(HOURS AFTER BURST)
IF Te > H+ 25 HRS.
$D = R_{T_e} \times T_s$

Figure A-XLV

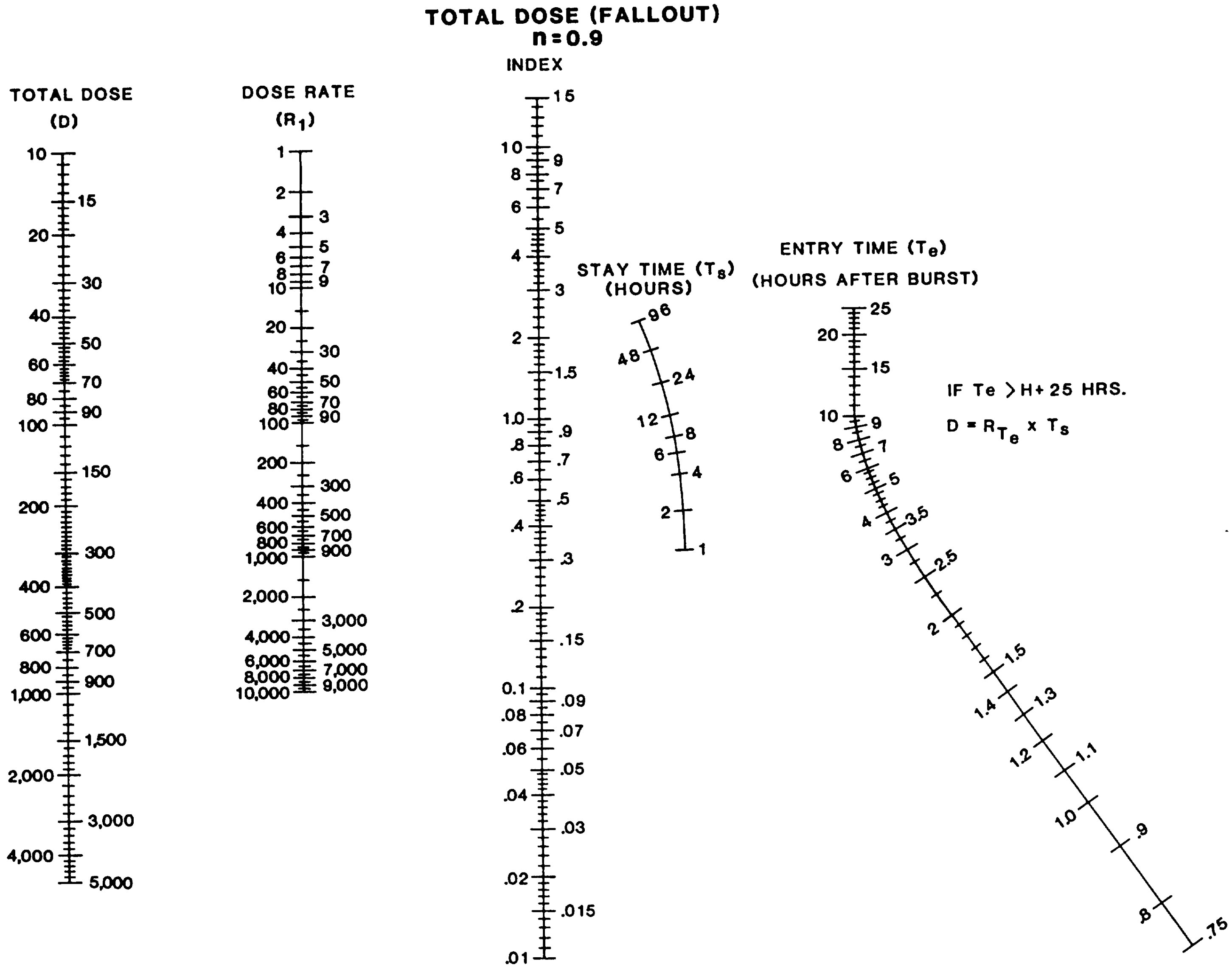


Figure A-XLVI

NATO/PfP UNCLASSIFIED

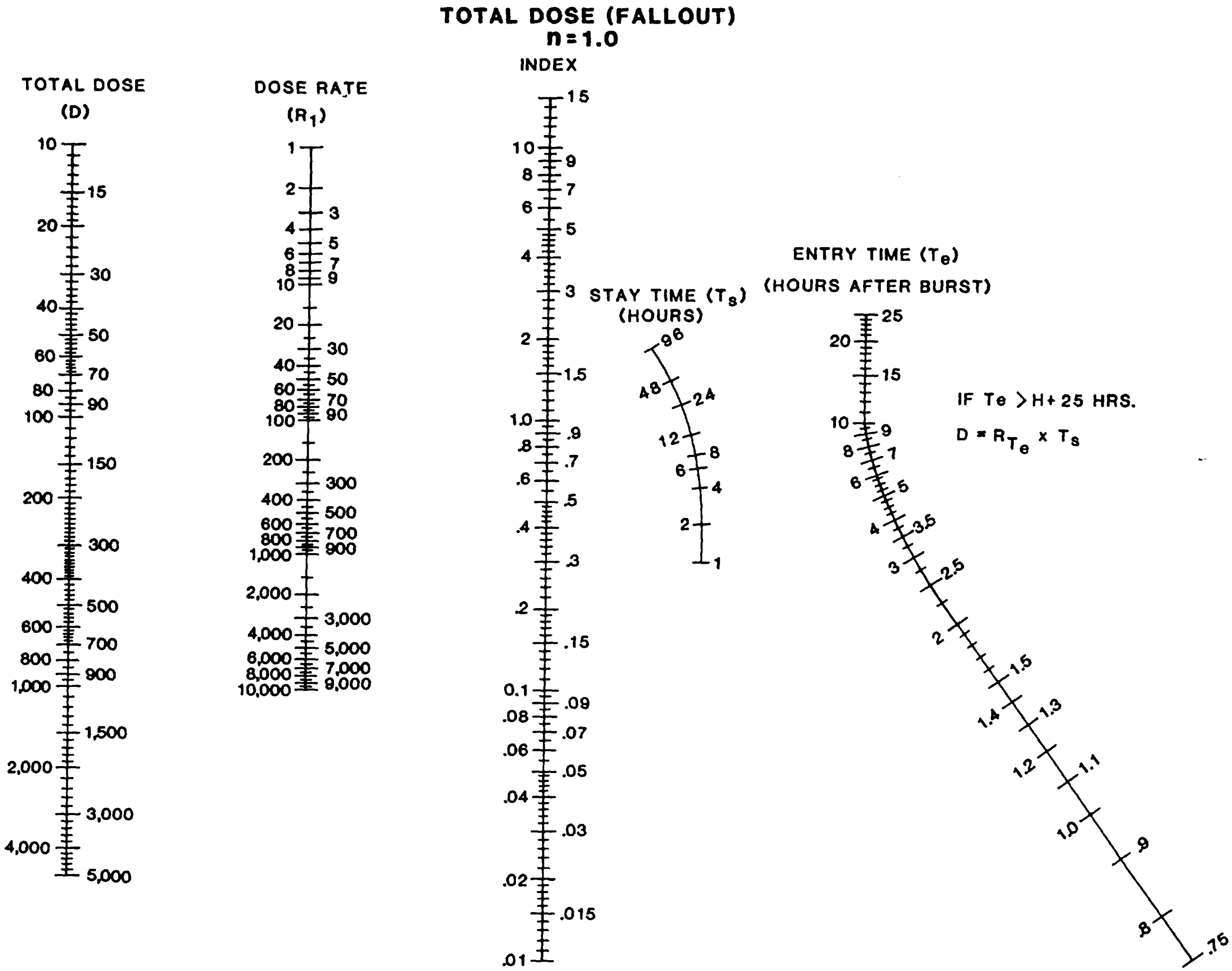


Figure A-XLVII

TOTAL DOSE (FALLOUT)
n = 1.1

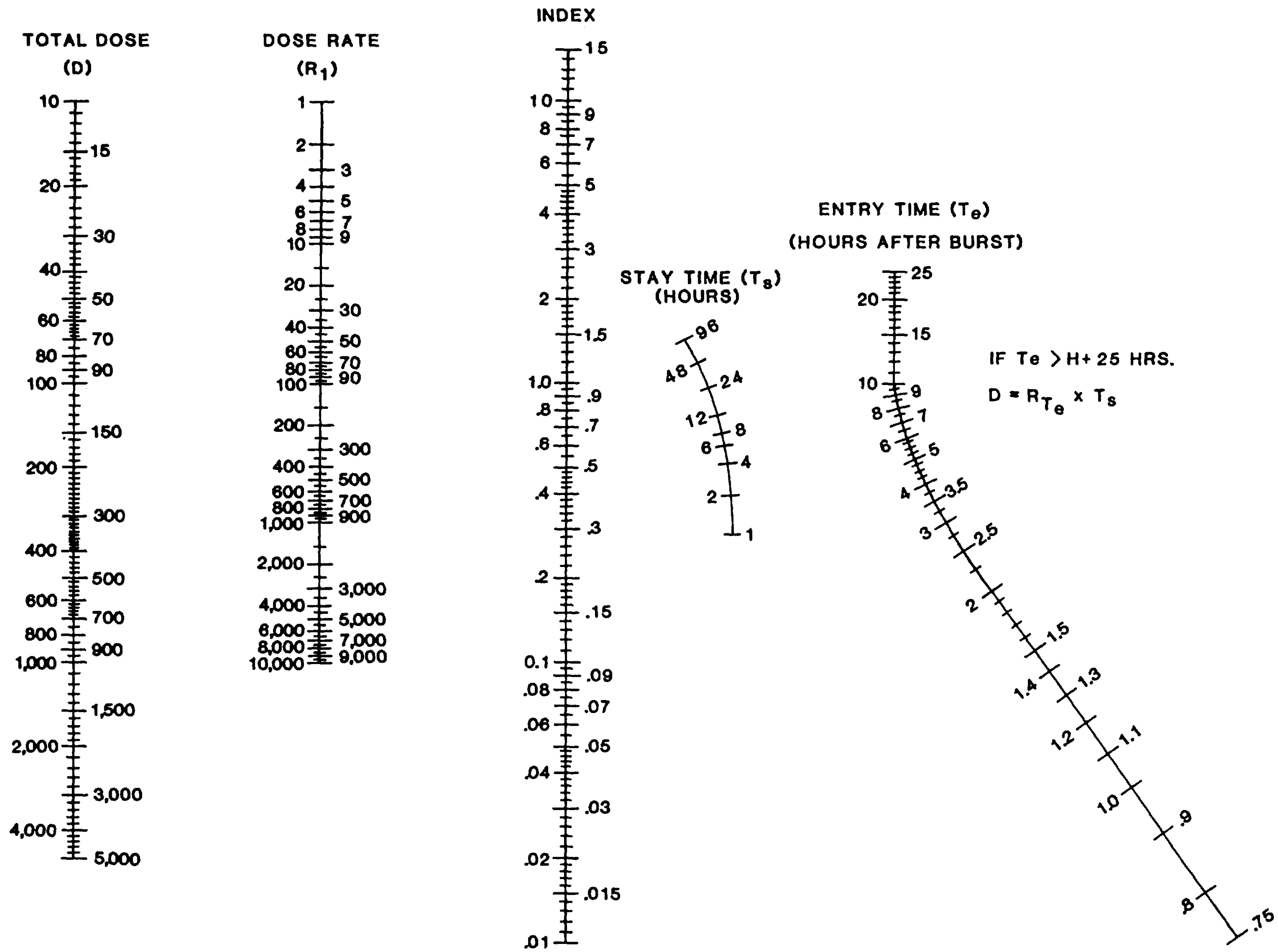


Figure A-XLVIII

NATO/PfP UNCLASSIFIED

TOTAL DOSE (FALLOUT)
n = 1.2

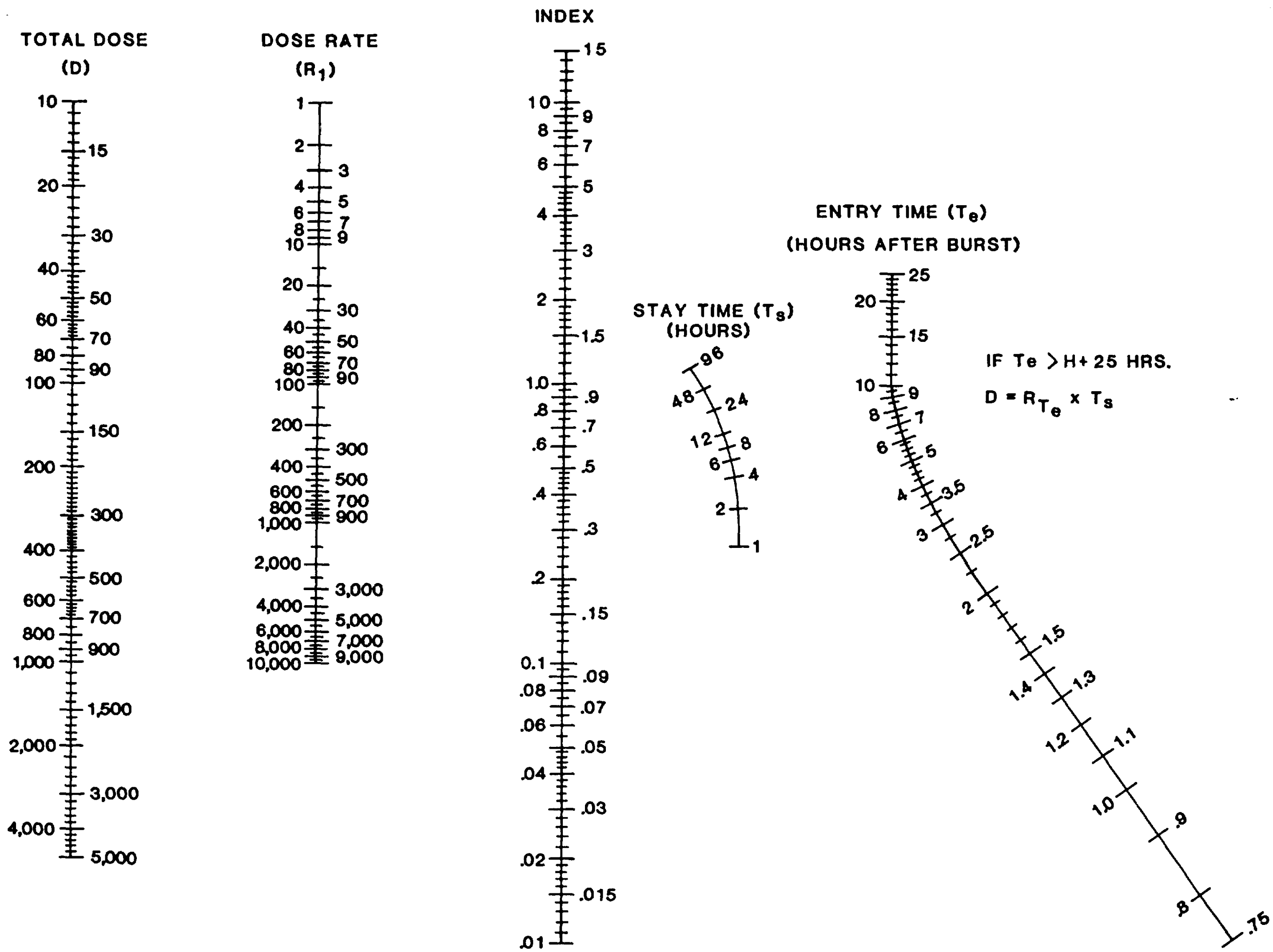


Figure A-XLIX

TOTAL DOSE (FALLOUT)
n = 1.3

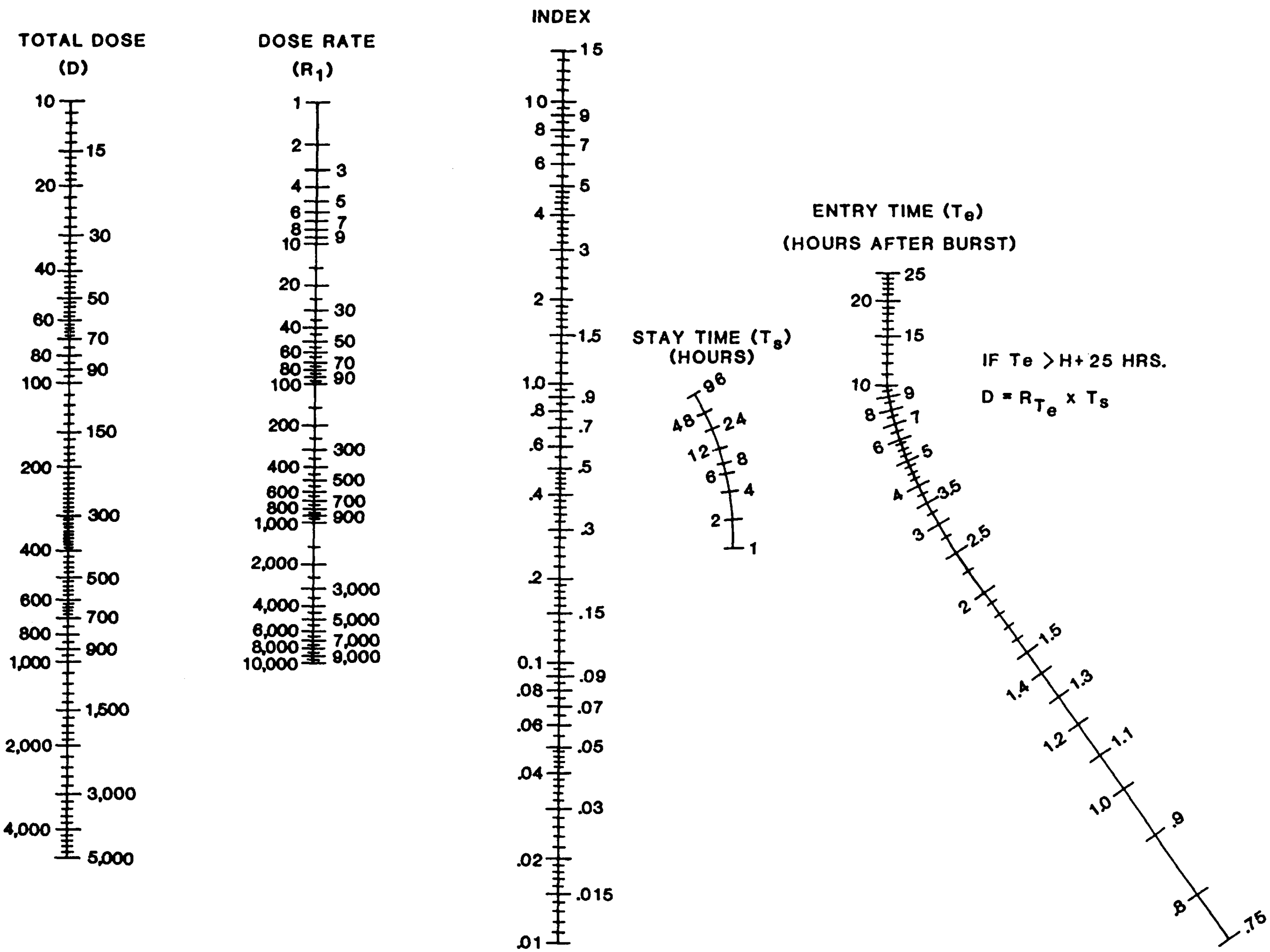


Figure A-L

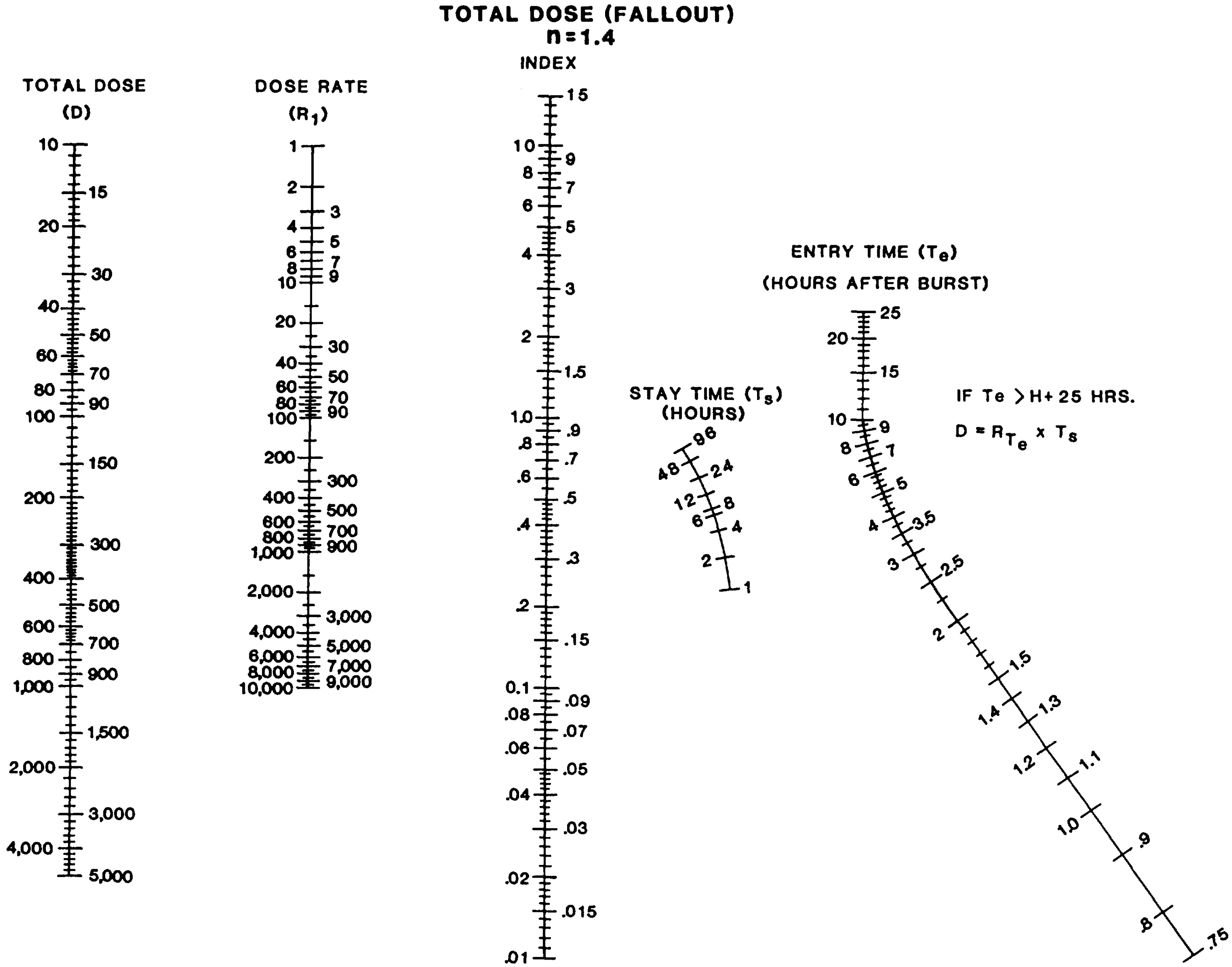

TOTAL DOSE (FALLOUT)
n=1.4
TOTAL DOSE
(D)
DOSE RATE
(R_1)
INDEX
STAY TIME (T_s)
(HOURS)
ENTRY TIME (T_e)
(HOURS AFTER BURST)
IF Te > H+25 HRS.
D = R_{T_e} x T_s

Figure A-LI

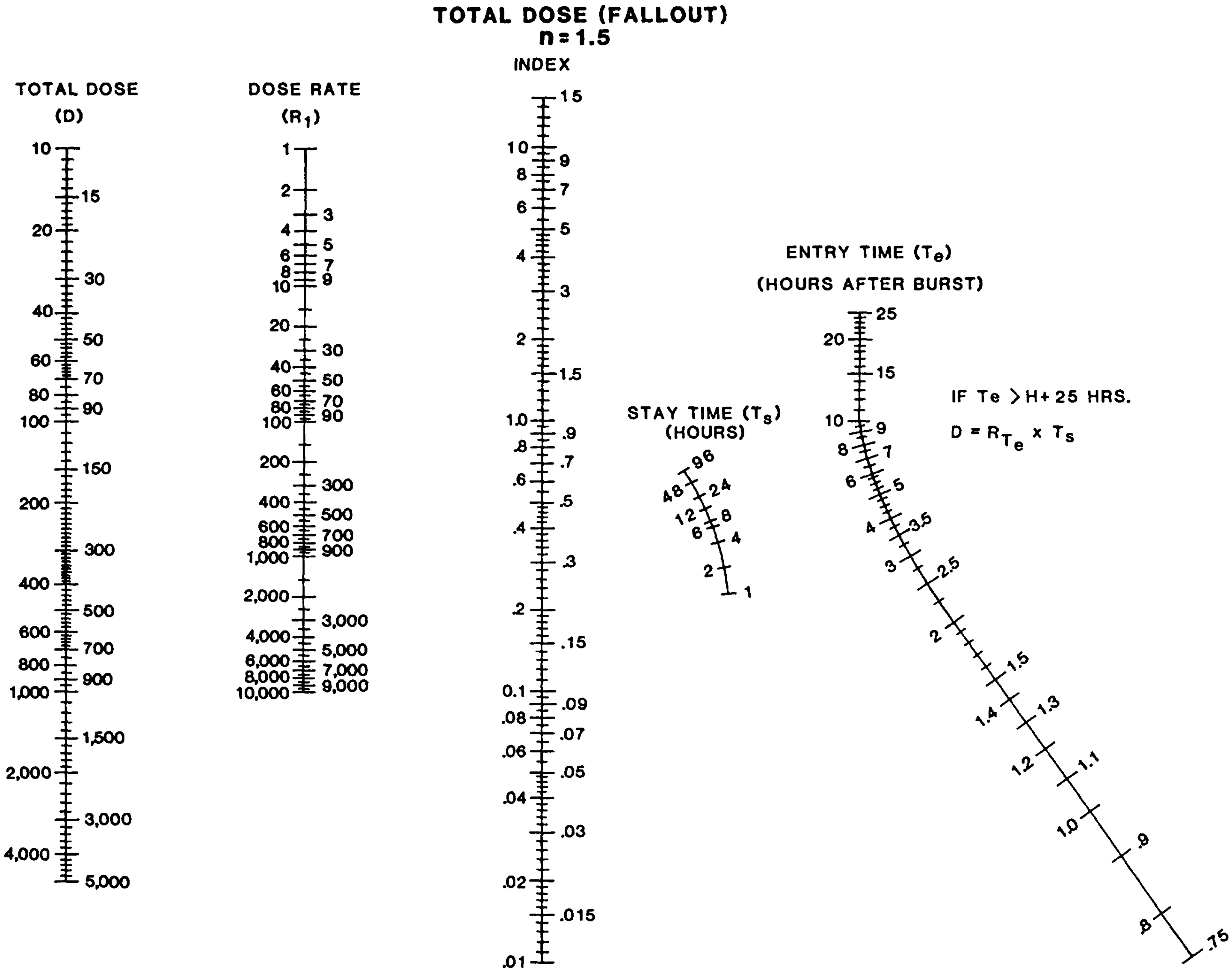

TOTAL DOSE (FALLOUT)
n = 1.5
TOTAL DOSE
(D)
DOSE RATE
(R_1)
INDEX
ENTRY TIME (T_e)
(HOURS AFTER BURST)
STAY TIME (T_s)
(HOURS)
IF Te > H+ 25 HRS.
$D = R_{T_e} \times T_s$

Figure A-LII

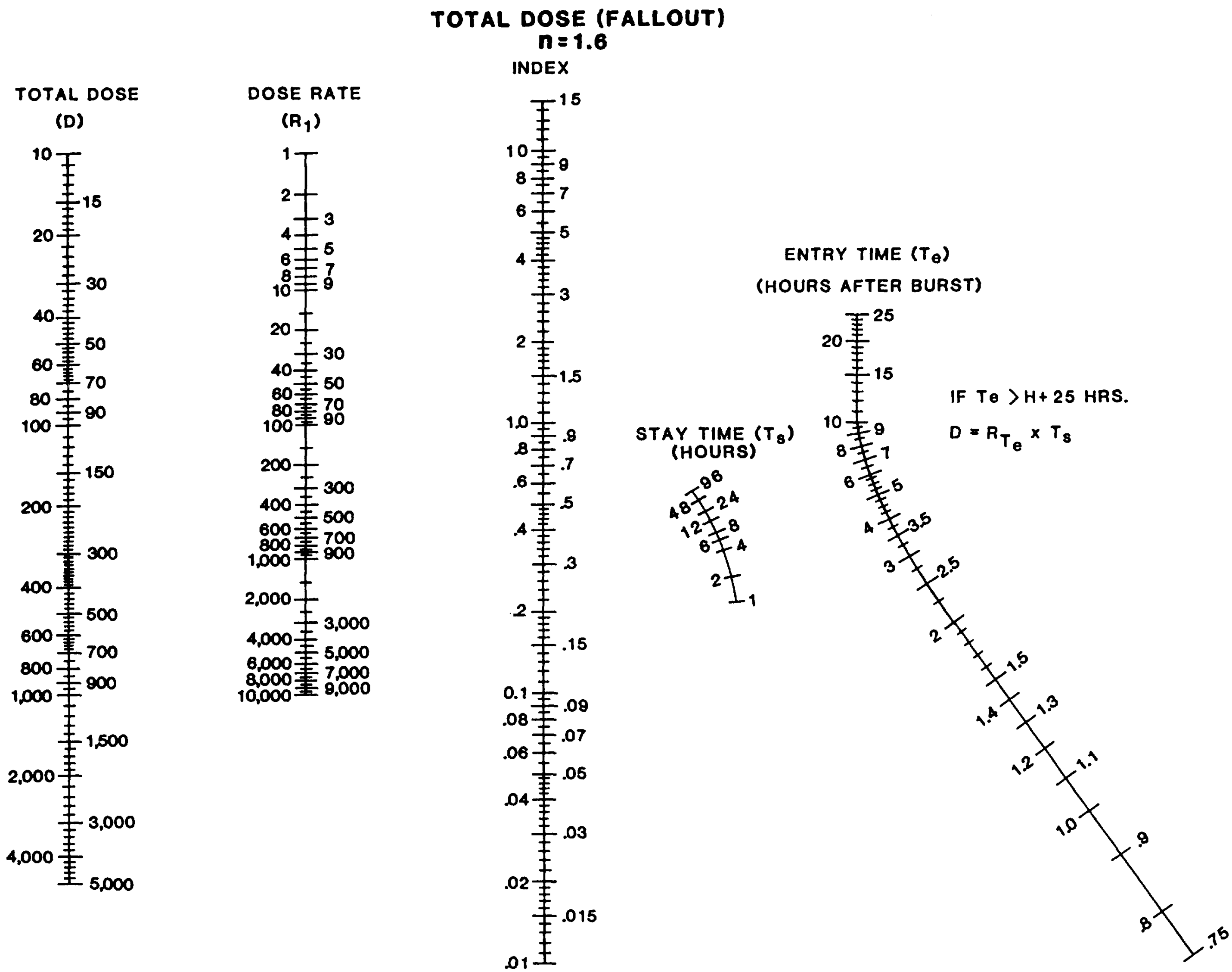


Figure A-LIII

TOTAL DOSE (FALLOUT)
n=1.7

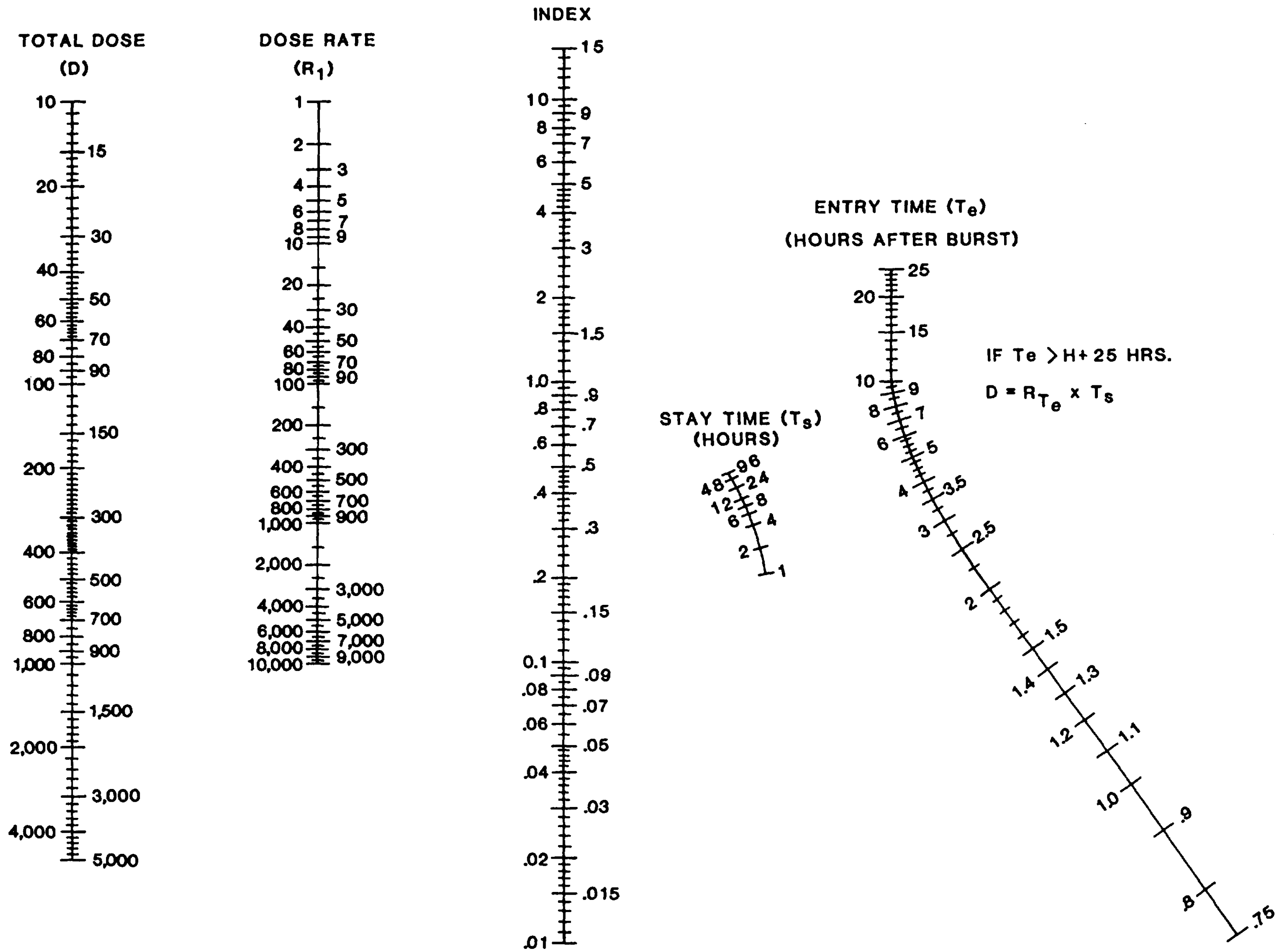


Figure A-LIV

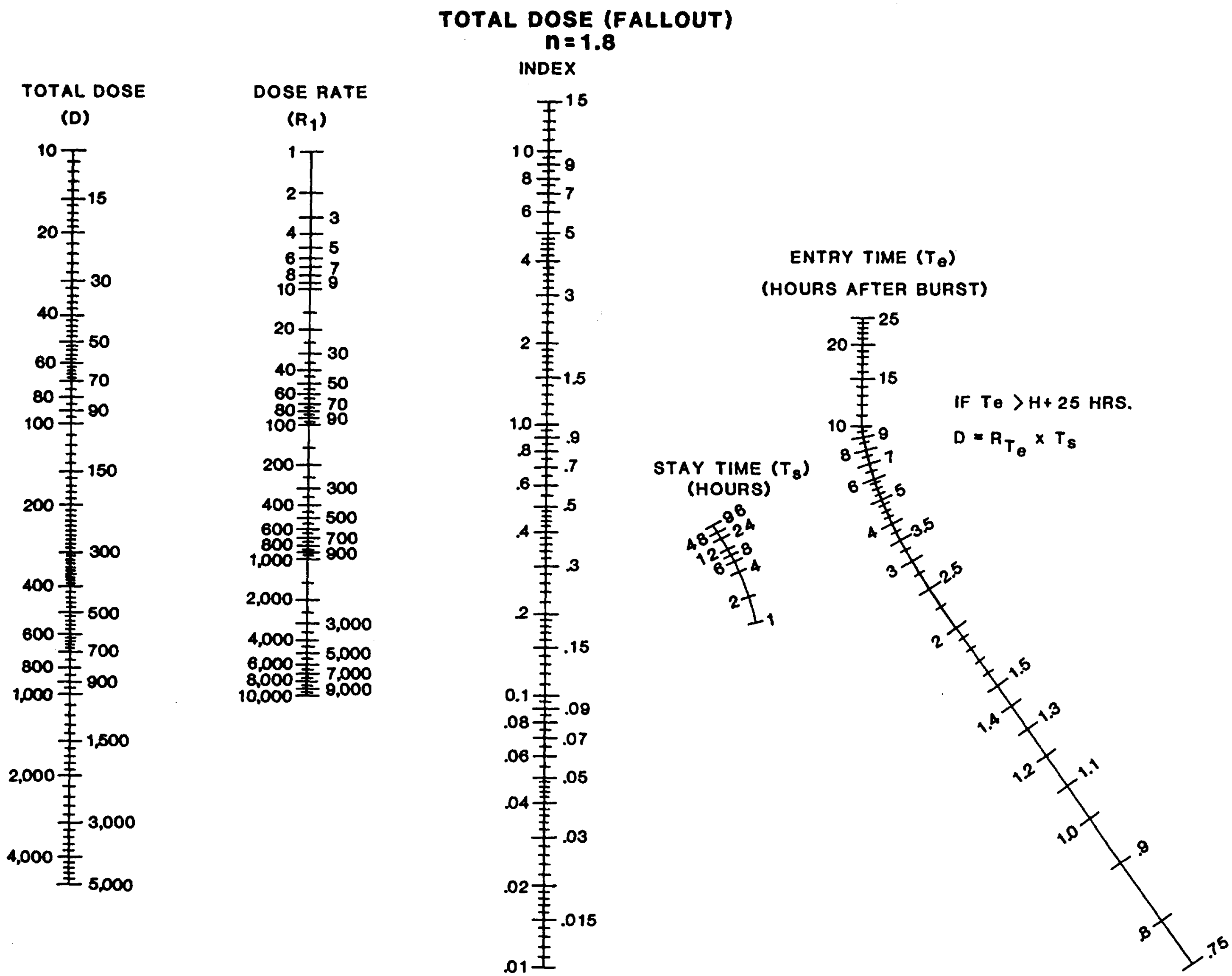


Figure A-LV

NATO/PfP UNCLASSIFIED

ATP-45(C)

TOTAL DOSE (FALLOUT)
n=1.9

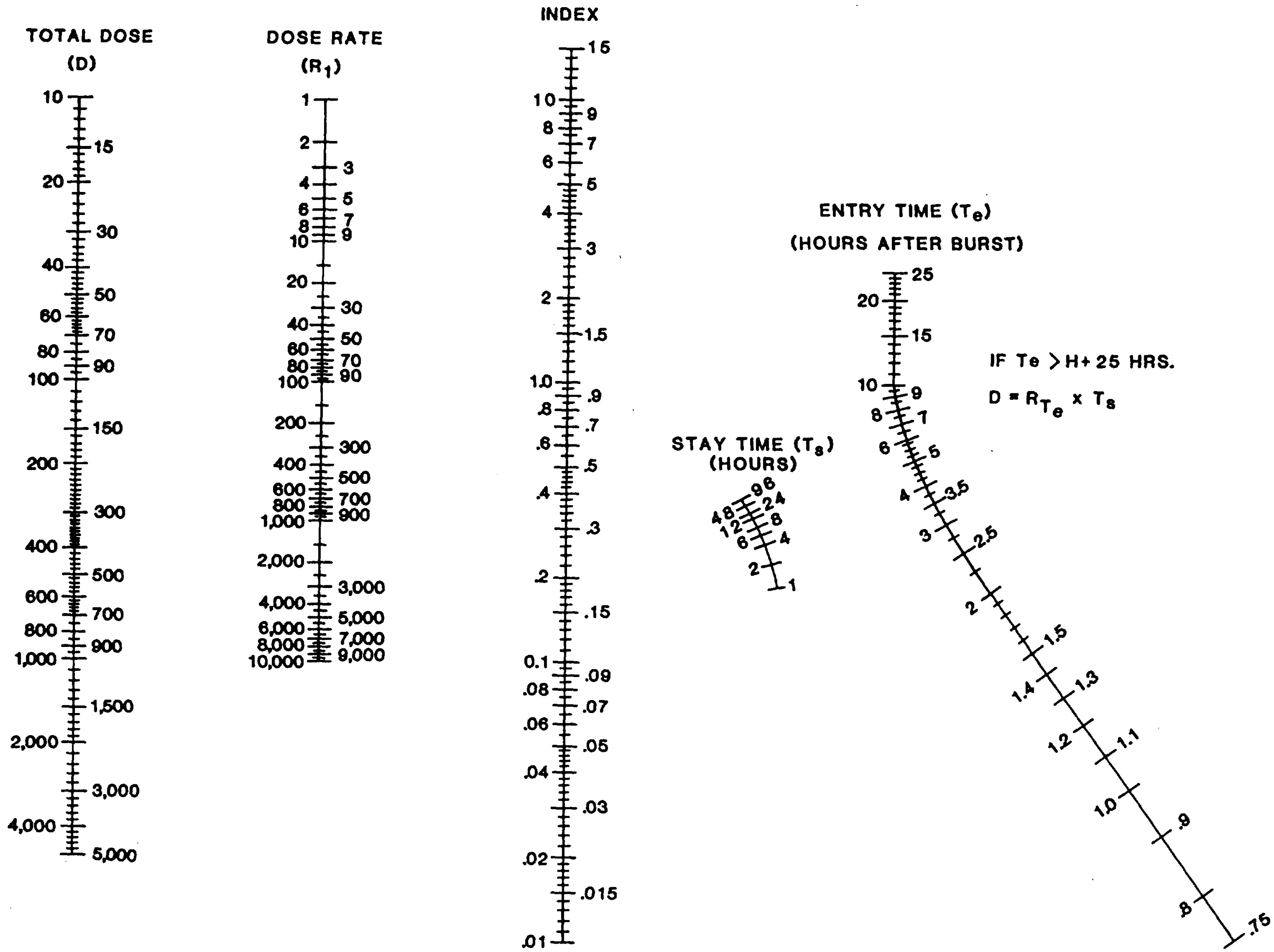


Figure A-LVI

NATO/PfP UNCLASSIFIED

TOTAL DOSE (FALLOUT)
n = 2.0

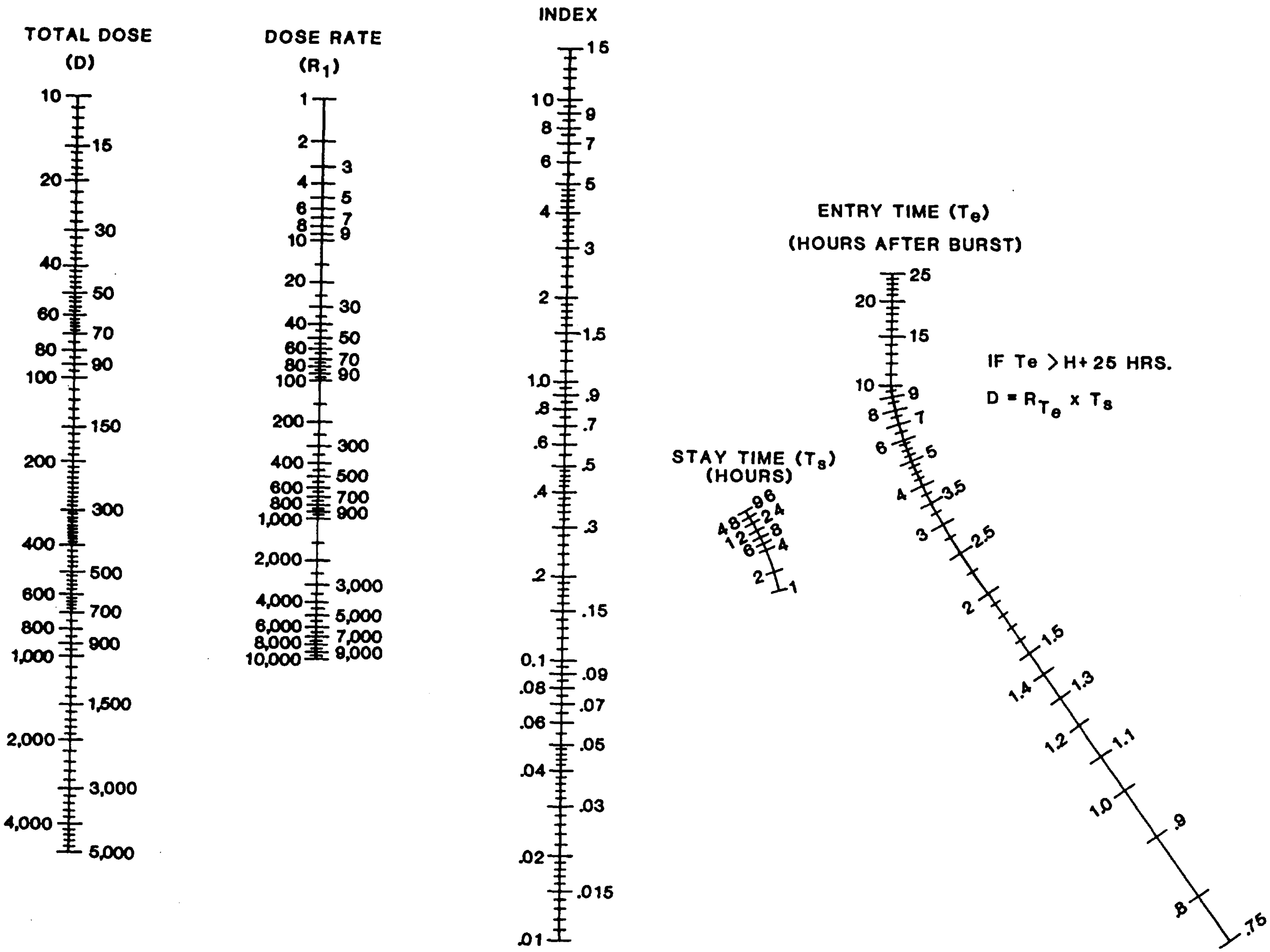


Figure A-LVII

NATO/PfP UNCLASSIFIED

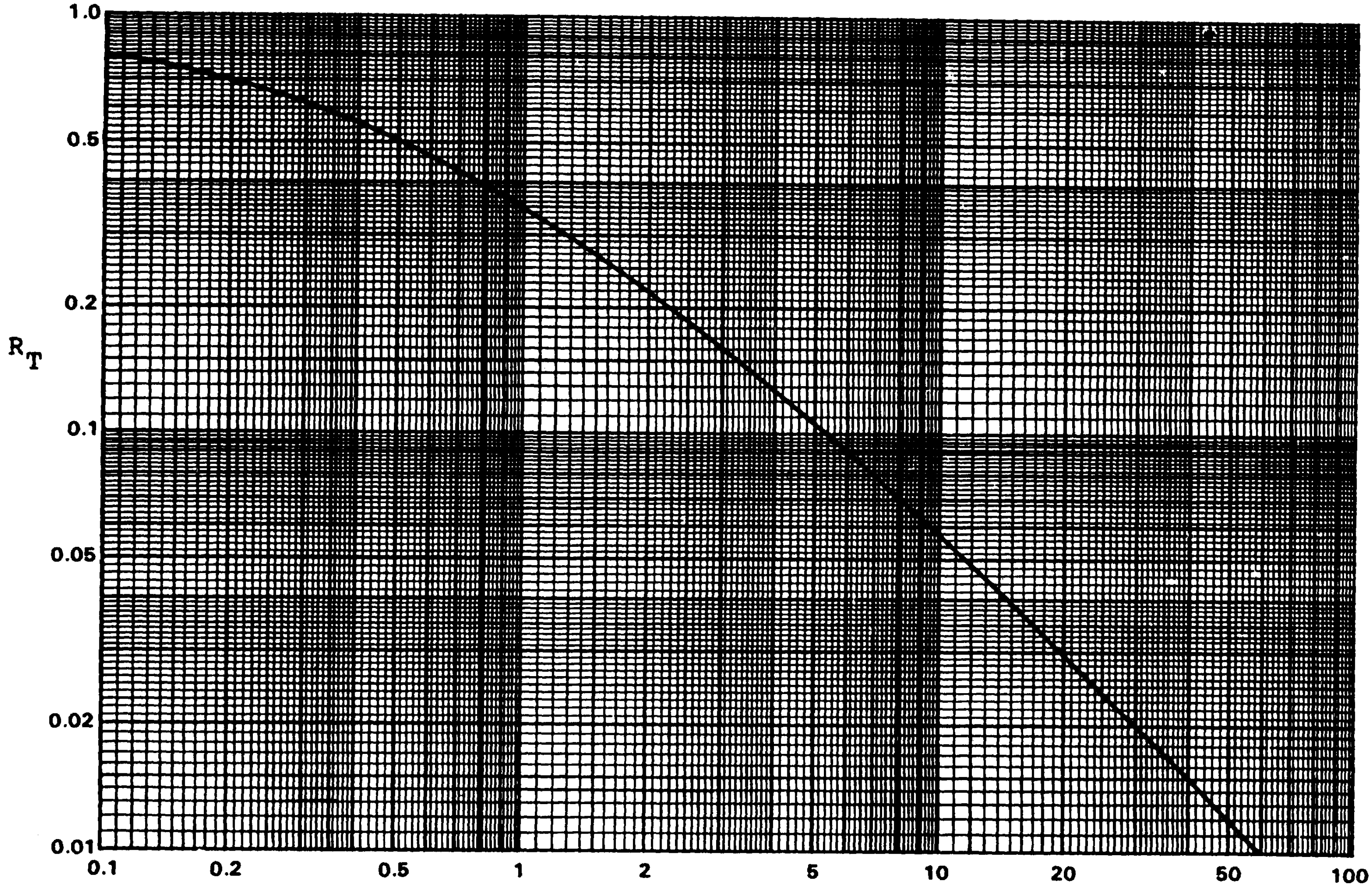


Figure A-LVIII, Multiplication Factor

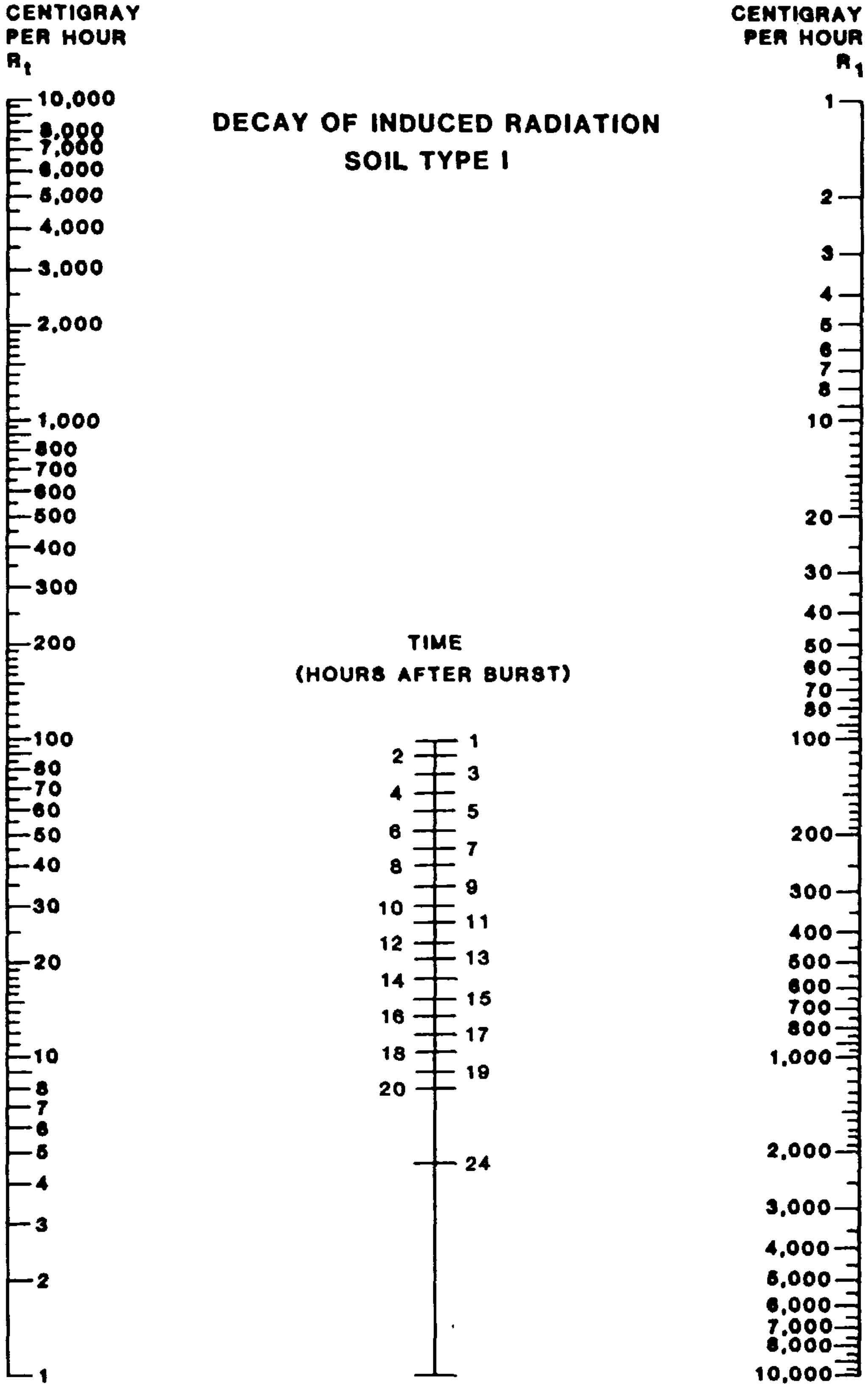

CENTIGRAY
PER HOUR
R_t
10,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
800
700
600
500
400
300
200
100
80
70
60
50
40
30
20
10
8
7
6
5
4
3
2
1
DECAY OF INDUCED RADIATION
SOIL TYPE I
TIME
(HOURS AFTER BURST)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
24
CENTIGRAY
PER HOUR
R_1
1
2
3
4
5
6
7
8
10
20
30
40
50
60
70
80
100
200
300
400
500
600
700
800
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
10,000

Figure A-LIX

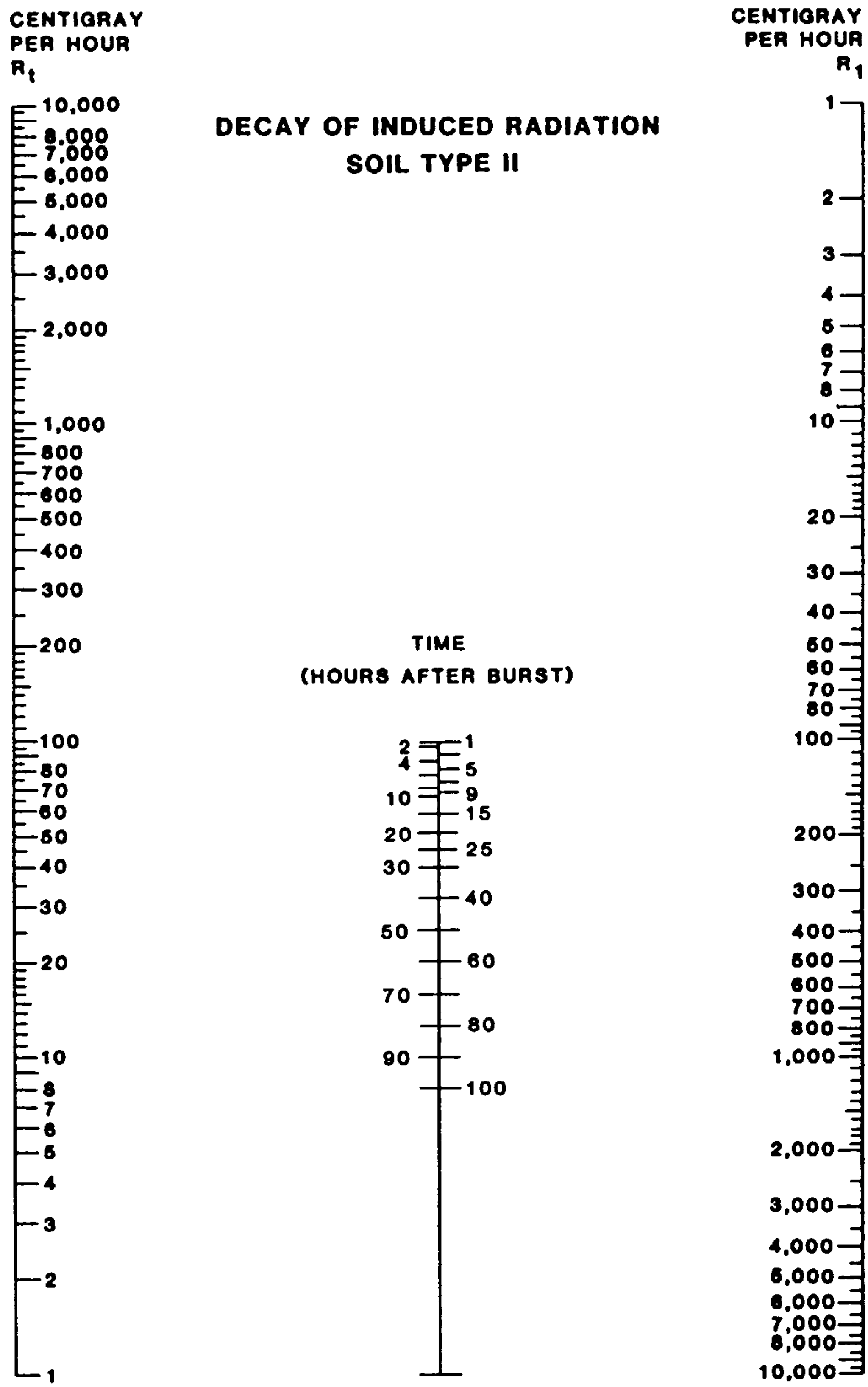

CENTIGRAY
PER HOUR
R_t
CENTIGRAY
PER HOUR
R_1
DECAY OF INDUCED RADIATION
SOIL TYPE II
TIME
(HOURS AFTER BURST)
10,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
800
700
600
500
400
300
200
100
80
70
60
50
40
30
20
10
8
7
6
5
4
3
2
1
1
2
4
5
9
10
15
20
25
30
40
50
60
70
80
90
100

Figure A-LX

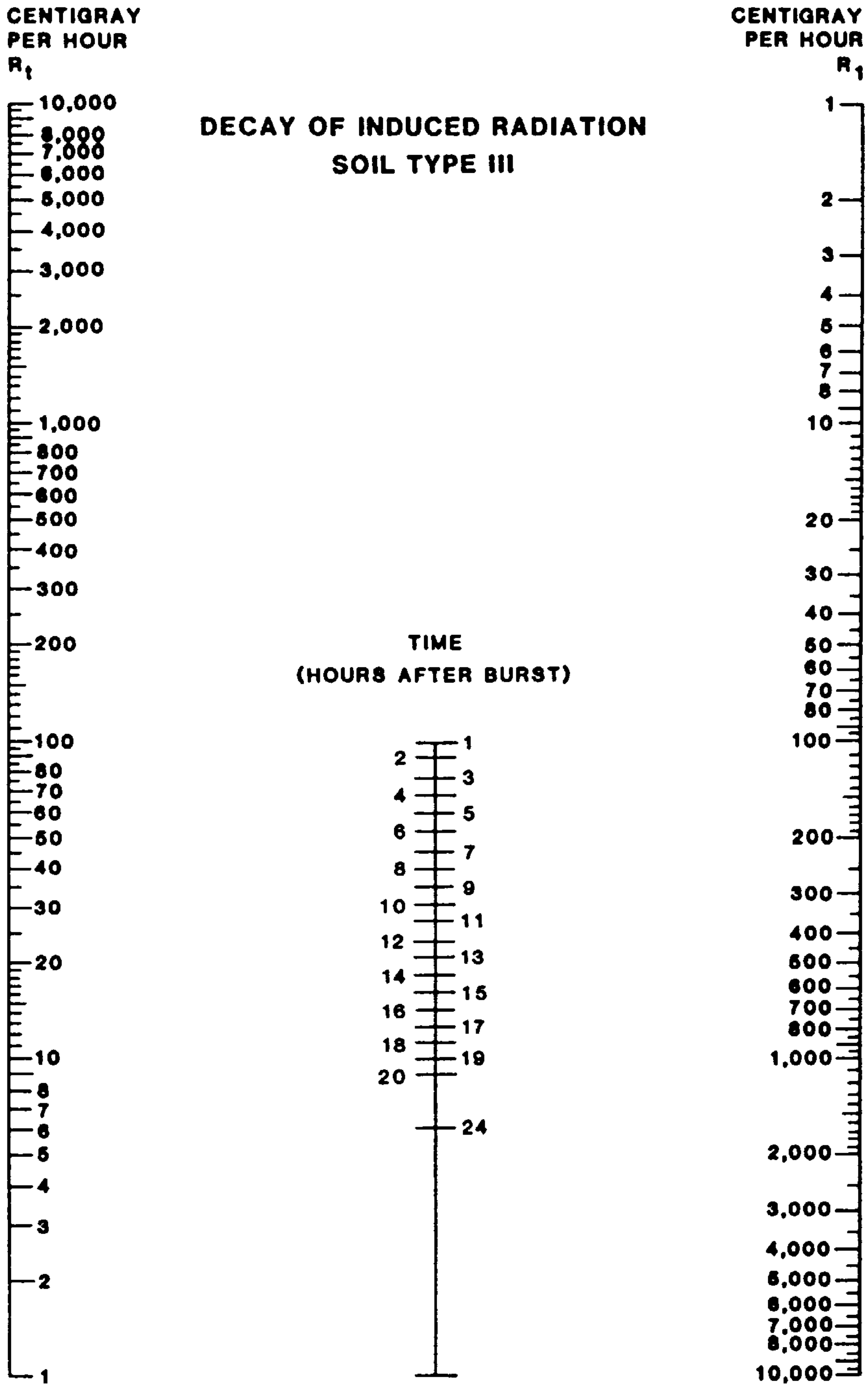

CENTIGRAY
PER HOUR
R_t
DECAY OF INDUCED RADIATION
SOIL TYPE III
CENTIGRAY
PER HOUR
R_1
10,000
8,000
7,000
6,000
5,000
4,000
3,000
2,000
1,000
800
700
600
500
400
300
200
100
80
70
60
50
40
30
20
10
8
7
6
5
4
3
2
1
TIME
(HOURS AFTER BURST)
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
24
1
2
3
4
5
6
7
8
10
20
30
40
50
60
70
80
100
200
300
400
500
600
700
800
1,000
2,000
3,000
4,000
5,000
6,000
7,000
8,000
10,000

Figure A-LXI

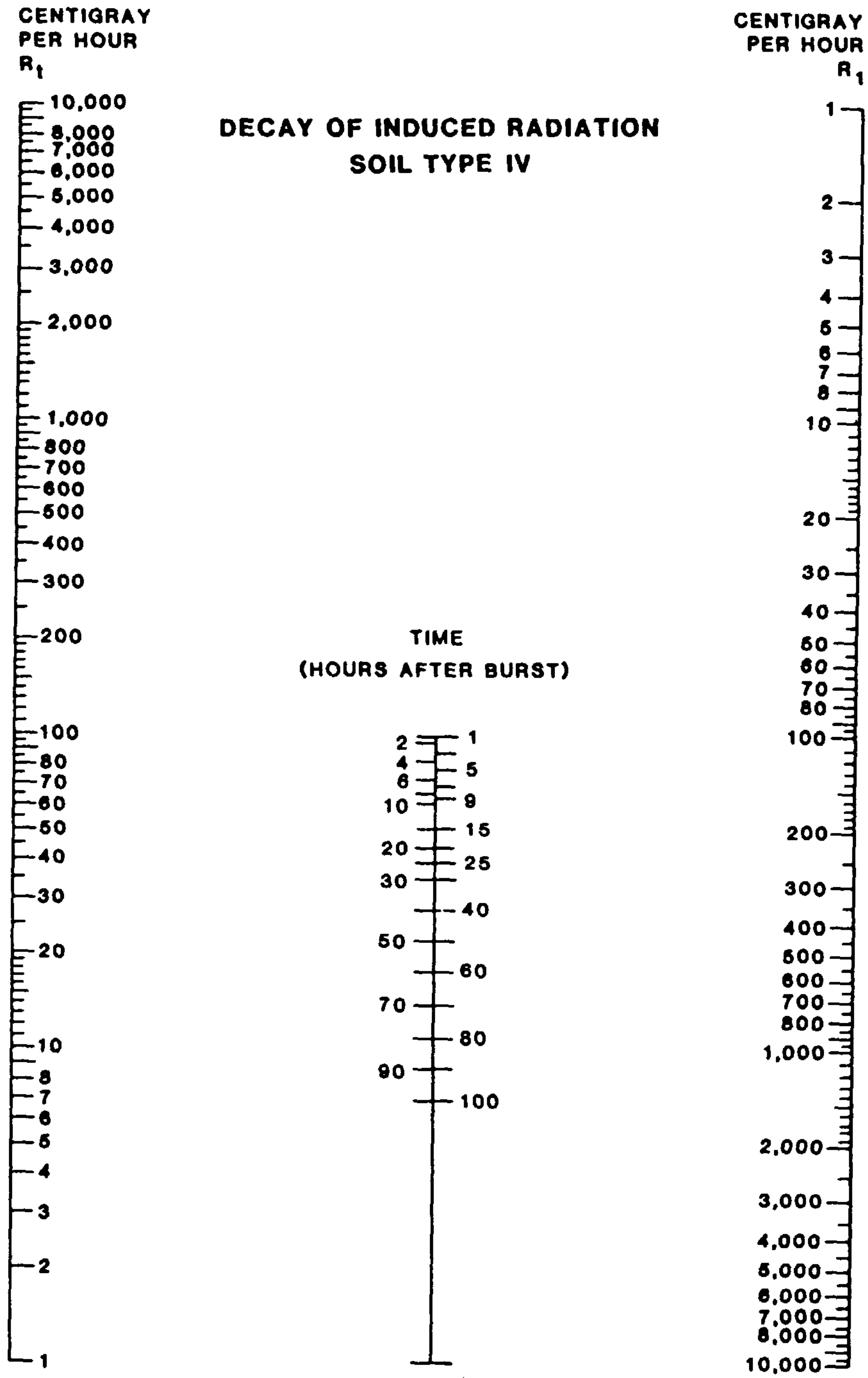


Figure A-LXII

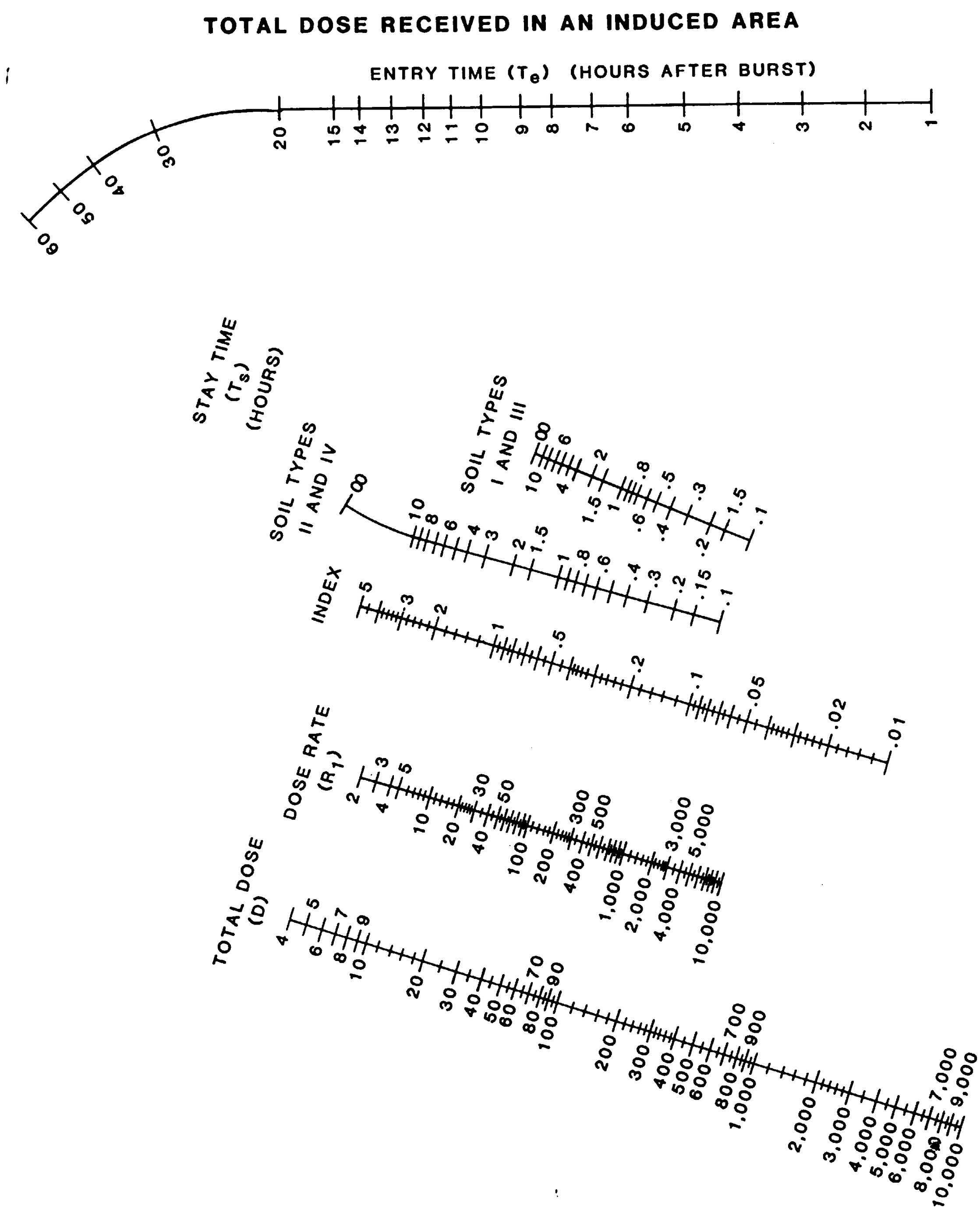


Figure A-LXIII

ANNEX B

ADP NBC MESSAGE TEXT FORMAT INSTRUCTIONS

B01. General

This Annex is designed for the user to have explanations of the ADP NBC Message Text Formats (MTF), as published in ADatP-3 (NATO Message Text Formatting System)

a. An ADP formatted NBC message consists of segments, sets and fields. A segment is a group of contiguous sets related by content. The sets are explained in Annex B, para B02. The fields related to specific sets are explained in this annex from para B03.

b. In the instructions the field contents are described by one of the following: A = alphabetic, N = numeric, S = special characters (e.g. &, *), B = blank, or X = any code. Combinations of the codes exist in some fields.

c. Fields must be filled with the number and type of characters, indicated in the legal entries listed in Annex C. However, some fields have variable length, which is indicated by giving a range for the number of characters (e.g. 1-20X).

d. Whenever a segment, set or field is repeatable, this is indicated by a preceding asterisk. For programming purposes the limits of repeatability are specified, e.g. (*=3) indicates that data can be entered up to 3 times.

e. If a repeatable segment is used, then all sets within that segment must be used each time that segment is repeated. If a repeatable field is repeated, then all following fields in the set must be repeated.

f. Although an asterisk is indicated it should not be entered into the field when actually filling it with characters.

g. A dash (-) may be inserted into a field when the information is not available.

h. In manual procedures all information under one set is put into one sentence. In ADP systems the information is subdivided into fields. Legal entries can be found in Annex C.

i. Certain fields will contain numeric values where the unit of measurement can be different e.g. kilometres or nautical miles. In these fields the unit of measurement must follow the numerical value.

j. In STRIKWARN, the units of measurement are default values and are therefore excluded from the fields.

k. All directional/angular measurements must be stated in either degrees (3N) or mils (4N) (i.e. 40 degrees = 040, 18 mils = 0018).

l. All sets or fields are either mandatory (M), operationally determined (O) or conditional (C) as defined in D02.

B02. List of Sets.

B02a. List of Sets for Common Message Heading.

SET:	**MEANING:**
EXER	EXERCISE IDENTIFICATION (1)
OPER	OPERATION CODEWORD (1)
MSGID	MESSAGE IDENTIFIER (1)
REF	REFERENCE (1)
GEODATUM	GEODETIC DATUM (1)
DTG	DATE TIME GROUP OF MESSAGE/REPORT CREATED (1)
ORGIDDFT	ORGANISATION DESIGNATOR OF DRAFTER/RELEASER (1)
NBCEVENT	TYPE OF NBC REPORT
	(1) Sets introduced to accommodate ADatP-3 requirements.

B02b. List of Sets for NBC Reports

SET:	**MEANING:**
ALFA	STRIKE SERIAL NUMBER
BRAVO	LOCATION OF OBSERVER AND DIRECTION OF ATTACK OR EVENT
CHARLIE	DATE-TIME GROUP OF REPORT OR OBSERVATION AND END OF EVENT
DELTA	DATE-TIME GROUP OF ATTACK OR DETONATION AND ATTACK END END
FOXTROT	LOCATION OF ATTACK OR EVENT
GOLF	DELIVERY AND QUANTITY INFORMATION
HOTEL	TYPE OF NUCLEAR BURST
INDIA	RELEASE INFORMATION ON BIOLOGICAL/CHEMICAL AGENT ATTACKS OR ROTA EVENTS
JULIET	FLASH-TO-BANG TIME IN SECONDS
KILO	CRATER DESCRIPTION
LIMA	NUCLEAR BURST ANGULAR CLOUD WIDTH AT H+5 MINUTES
MIKE	STABILISED CLOUD MEASUREMENT AT H+10 MINUTES
MIKER	DESCRIPTION AND STATUS OF ROTA EVENT
NOVEMBER	ESTIMATED NUCLEAR YIELD IN KILOTONS

OSCAR	REFERENCE DATE-TIME GROUP FOR ESTIMATED CONTOUR LINES
PAPAA	PREDICTED ATTACK/RELEASE AND HAZARD AREA
PAPAB	DETAILED FALLOUT HAZARD PREDICTION PARAMETERS
PAPAC	RADAR DETERMINED EXTERNAL CONTOUR OF RADIOACTIVE CLOUD
PAPAD	RADAR DETERMINED DOWNWIND DIRECTION OF RADIOACTIVE CLOUD
PAPAX	HAZARD AREA LOCATION FOR WEATHER PERIOD
QUEBEC	LOCATION OF READING/SAMPLE/DETECTION AND TYPE OF SAMPLE/DETECTION
ROMEO	LEVEL OF CONTAMINATION, DOSE RATE TREND & DECAY RATE TREND
SIERRA	DATE-TIME GROUP OF READING OR INITIAL DETECTION OF CONTAMINATION
TANGO	TERRAIN/TOPOGRAPHY AND VEGETATION DESCRIPTION
WHISKEY	SENSOR INFORMATION
XRAYA	ACTUAL CONTOUR INFORMATION
XRAYB	PREDICTED CONTOUR INFORMATION
YANKEE	DOWNWIND DIRECTION AND DOWNWIND SPEED
ZULU	ACTUAL WEATHER CONDITIONS
GENTEXT	GENERAL TEXT

B02c. List of Sets for Meteorological Reports.

SET:	**MEANING:**
AREAM	AREA OF VALIDITY (2)
ZULUM	PERIOD OF VALIDITY (2)
UNITM	UNITS OF MEASUREMENT (2)
ALFAM	EFFECTIVE DOWNWIND FOR YIELD GROUP ALFA (2)
BRAVOM	EFFECTIVE DOWNWIND FOR YIELD GROUP BRAVO (2)
CHARLIEM	EFFECTIVE DOWNWIND FOR YIELD GROUP CHARLIE(2)
DELTAM	EFFECTIVE DOWNWIND FOR YIELD GROUP DELTA (2)
ECHOM	EFFECTIVE DOWNWIND FOR YIELD GROUP ECHO (2)
FOXTROTM	EFFECTIVE DOWNWIND FOR YIELD GROUP FOXTROT (2)
GOLFM	EFFECTIVE DOWNWIND FOR YIELD GROUP GOLF (2)
LAYERM	WIND CONDITIONS AT 2,000M INCREMENTS UP TO 30,000M (2)
WHISKEYM	SURFACE WEATHER FOR THE FIRST TWO HOUR PERIOD (2)
XRAYM	SURFACE WEATHER FOR THE SECOND TWO HOUR PERIOD (2)
YANKEEM	SURFACE WEATHER FOR THE THIRD TWO HOUR PERIOD (2)

(2) Letter “M” added to identify meteorological sets.

B02d. List of Sets for STRIKWARN.

SET:	MEANING:
ALFAW	STRIKWARN TARGET IDENTIFIER (3)
DELTAW	DATE-TIME OF STRIKE OR STRIKE CANCELLED (3)
FOXONEW	MINIMUM SAFE DISTANCE ONE (3)
FOXTWOW	MINIMUM SAFE DISTANCE TWO (3)
HOTELW	NUMBER OF SURFACE BURSTS (3)
INDIAW	NUMBER OF BURSTS IN A MULTIPLE STRIKE (3)
AKNLDG	ACKNOWLEDGE REQUIREMENT (1)

(1) Sets introduced to accommodate ADatP-3 requirements.
(3) Letter “W” added to identify warning sets.

B03. Common Message Heading.

The contents of these sets are common to all NBC ADP messages. The General Message Heading depends on regulations given by ADatP-3. It has to be followed by a Common NBC Message Heading (which is only the set NBCEVENT).

B03a. General Message Heading: Each set includes the occurrence (Occ) and ID (Set ID)

```
Occ     Set ID
(O)     EXER                    Exercise Identification
/-      /-      //
 |      (O) Exercise Additional Identifier (see ADatP-3), 4 - 16 AB
(M) Exercise Nickname, 1 - 56 X
```

```
(O)     OPER                    Operation Code Word
/-      /-      /-      /-      //
 |       |       |      (O) Secondary Option Nickname, 1 - 23 X
 |       |      (O) Option Nickname, 1 - 23 X
 |      (O) Plan Originator and Number, 5 - 36 X
(M) Operation Code Word, 1 - 32 AB
```

```
        (M)     MSGID           Message Identifier
/-      /-      /-      /-      /-      /-      //
 |       |       |       |       |      (O) Serial Number of Qualifier, 1 - 3 N
 |       |       |       |      (O) Qualifier (see ADatP-3), 3 A
 |       |       |      (O) Month Name, 3 A
 |       |      (O) Message Serial Number, 1 - 7 N
 |      (M) Originator, 1 - 30 X
(M) Message Text Format Identifier (see Annex C, C15), 3 - 20 X
```

```
(O)     REF**                   Reference(**=3)
/-      /-      /-      /-      /-      /-      /-*     // (*= 3 )
|       |       |       |       |       |       (O) Signal Indicator Code (SIC) (see APP-3), 3 AN, or
|       |       |       |       |       |       (O) File Number, 1 - 10 X
|       |       |       |       |       (O) Special Notation (see ADatP-3), 5 A
|       |       |       |       (O) Reference Serial Number, 1 – 30 X, or
|       |       |       |       (O) Document Serial Number, 1 - 10 X
|       |       |       (M) Day-Time Group of Reference, 4 Digit Year, 14 AN or
|       |       |       (M) Day-Time of Reference, 7 AN, or
|       |       |       (M) Day-Time and Month of Reference, 10 AN, or
|       |       |       (M) Date of Reference, DDMMMYYYY, 9 AN, or
|       |       |       (M) Date of Reference, DDMMYYYY, 8 N, or
|       |       |       (M) Date of Reference, YYYYMMDD 8 N, or
|       |       |       (M) Month-Year, 7AN
|       |       (M) Originator, 1 - 30 X
|       (M) Communication Type (see ADatP-3), 3-20 X
(M) Serial Letter, 1 A
```

Explanation of Repeatable Set and Field
Set REF: Field 7 is repeatable to accommodate up to 3 data entries.
Set REF is repeatable three times

```
Occ     Set ID
(C)     GEODATUM            Geodetic  Datum
/-      //
(M) Geodetic Datum, 3-25 X
```

Explanation of conditions
Set GEODATUM is required when any geographic position occurs in the message.

```
        (M)     DTG                   Date Time Group of Message/Report Created
/-      //
(M) Date-Time-Group in Zulu-Time, Month and Year, 14 AN
```

```
(M)  ORGIDDFT        Organisation Designator of Drafter/Releaser
/-   /-   /-   /-   /-   /-   /-   /-   /-   /-   //
|    |    |    |    |    |    |    |    |    (C) Unit Identification Code (UIC), 7-9 AN
|    |    |    |    |    |    |    |    (M) Armed Service, 1AN, or
|    |    |    |    |    |    |    |    (M) Civilian Agency Code, 2-8 AN
|    |    |    |    |    |    |    (M) Higher Formation Name, 1-15 ANS
|    |    |    |    |    |    (M) Unit Role Indicator Code 'D', 2-6 A
|    |    |    |    |    (M) Unit Role Indicator Code 'C', 2-6 A
|    |    |    |    (M) Unit Role Indicator Code 'B', 2-6 A
|    |    |    (M) Unit Role Indicator Code 'A', 2-6 A
|    |    (M) Geographical Entity, 2 A
|    (M) Unit Size Indicator, 1-7 A
(M) Unit Designation Name, 1-15 ANS
```

For further information on entries, refer to national standing operating procedures
Explanation of Conditions
Set ORGIDDFT: If Field 2 is 'CORPS', 'ARMY', 'AG', 'MOD' or 'MD' then Field 10 is mandatory, otherwise it is operationally determined.

B03b. Common NBC Message Heading

```
Occ Set ID
     (M)  NBCEVENT       Type of NBC Report
/-   /-   //
|    (O) Validation Code, 1-10X
(M) Type of NBC Report (see Annex C, C.16.a), 3 - 4  A, or
(M) Type of NBC Weather Report (see Annex C, C.16b), 3 A
```

Note: Field 2 is used only with automated data processing systems

B04. Sets for NBC 1 - 6 and NBCSITREP

The occurrence depends on which message the set is to be used. An occurrence matrix is shown at Annex D.

Set ID

ALFA **Strike Serial Number**

/- /- /- /- /- //
| | | | (O) Grading of Message/Report, 1-3 N.
| | | (M) Type of incident (see Annex C, C16c.), 1-2 A.
| | (M) Sequence Number, 1-10 X.
| (M) Code for Originator, 1-6 X.
(M) Nationality, 2A or:
(M) Area Control Centre Code, 2-3 AN.

Note: See Paragraph B07 for detailed explanation of field entries.

BRAVO **Location of Observer and Direction of Attack or Event**

/- /- //
| (M) Direction of Attack or Event from Observer and Unit of Measurement
| (see Annex C, C10), 6-7AN
Location of Observer, one of the following:
(M) Geographic Place Name, 1-30 X, or
(M) Geographic Position, LAT/LONG, Seconds, 15 AN, or
(M) Geographic Position, UTM 10-Metre, 13 AN, or
(M) Geographic Position, LAT/LONG, Minutes, 11 AN, or
(M) Geographic Position, UTM 100-Metre, 11 AN.

CHARLIE **Date Time Group of Report or Observation and End of Event**

/- /- //
| (O) Date Time-Group Event ended in Zulu-Time, Month and Year, 14 AN
(M) Date-Time-Group of Report or Observation in Zulu-Time, Month and Year, 14 AN

DELTA **Date Time Group of Attack or Detonation and Attack End**

/- /- //
| (O) Date Time-Group Attack ended in Zulu-Time, Month and Year, 14 AN
(M) Date-Time-Group of Attack or Detonation in Zulu-Time, Month and Year, 14 AN

FOXTROT **Location of Attack or Event**

/-* /- // (* = 6)
| (M) Location Qualifier (see Annex C, C17), 2A
Attack or Event Location, one of the following:
(M) Geographic Place Name, 1-30 X, or
(M) Geographic Position, LAT/LONG, Seconds, 15 AN, or
(M) Geographic Position, UTM 10-Metre, 13 AN, or
(M) Geographic Position, LAT/LONG, Minutes, 11 AN, or
(M) Geographic Position, UTM 100-Metre, 11 AN

Explanation of Repeatable Field
Set FOXTROT: Fields 1-2 are repeatable to accommodate up to 6 data entries in order to define a line or area attack.

Set ID

GOLF **Delivery and Quantity Information**

/- /- /- /- /- //
| | | | (M) Number of Agent Containers, 1 - 3 N, or
| | | | (M) Size of Release (see Annex C, C04c.), 3 A
| | | (M) Type of Agent Containers (see Annex C, C04b), 3 A
| | (M) Number of Delivery Systems, 1-3 N
| (M) Type of Delivery (see Annex C, C04a), 3 A
(M) Suspected/Observed Event (see Annex C, C05), 3 A

HOTEL **Type of Nuclear Burst**

/- //
(M) Type of Nuclear Burst (see Annex C, C12), 3-4 A

INDIA **Release Information on Biological/ Chemical Agent Attacks or ROTA Events.**

/- /- /- /-* // (* = 2)
| | | (O) Type of Detection (see Annex C, C25a) 3-5 A
| | (O) Type of Persistency (see Annex C, C02), 1-3 A
| (O) Type of Agent (see Annex, C03a), 1-4 A , or
| (O) Agent Name (see Annex, C03b), 1-4 A or
| (O) UN/NA Identification Number (see ERG), 4 N
(M) Type of Agent-Release-Height (see Annex C, C12), 3-4 A

Explanation of Repeatable fields.
Set INDIA: Field 4 is repeatable to accommodate up to 2 entries in order to provide information on multiple types of detection.

JULIET **Flash-to-Bang Time in Seconds**

/- //
(M) Flash-to-Bang Time in Seconds, 1-3 N

KILO **Crater Description**

/- /- //
| (O) Crater Width and Unit of Measurement (see Annex C, C08), 2-7 AN
(M) Crater Indicator (see Annex C, C23), 3-6 A

LIMA **Nuclear Burst Angular Cloud Width at H+5 Minutes**

/- //
(M) Angular Cloud Width (at H + 5 Min) and Unit of Measurement (see Annex C, C11), 6-7 AN

MIKE **Stabilised Cloud Measurement at H+10 Minutes**

/-* /- /- // (* = 2)
| | (M) Cloud Height and Unit of Measurement, (see Annex C, C08), 2-7 AN
| (M) Cloud Angle and Unit of Measurement (see Annex C, C11), 6-7 AN
(M) Cloud Section (see Annex C, C24), 3 A

Explanation of Repeatable Field
Set MIKE: Fields 1-3 are repeatable to accommodate up to 2 data entries in order to describe the cloud height and/or the cloud angle for cloud top and/or for cloud bottom.

MIKER **Description and Status of ROTA Event**

/- /- //
| (M) Status of ROTA-Event (see Annex C, C30) 4-5 A
(M) Description of ROTA-Event (see Annex C, C29), 4-6 A

Set ID

NOVEMBER **Estimated Nuclear Yield in Kilotons**

/- //

(M) Estimated Nuclear Yield in Kilotons, 1-6 NS

OSCAR **Reference Date Time Group for Estimated Contour Lines**

/- //

(M) Reference Date-Time-Group for estimated contour lines in Zulu-Time, Month and Year, 14 AN

PAPAA **Predicted Attack/Release and Hazard Area**

```
/-   /-   /-   /-   //
|    |    |    (M) Duration of Hazard in Hazard Area and Unit of Measurement
|    |    |        (see Annex C, C09b), 5-8 ANS
|    |    (M) Hazard Area Distance (see para 1211 for CHEM or para 910 for BIO)
|    |        and Unit of Measurement (see Annex C, C08), 2-7 AN
|    (M) Duration of Hazard in Attack or Release Area and Unit of Measurement
|        (see Annex C, C09b), 5-8 ANS
(M) Attack or Release Area Radius and Unit of Measurement (see Annex C, C08), 2-7 AN
```

PAPAB **Detailed Fallout Hazard Prediction Parameters**

```
/-   /-   /-   /-   /-   //
|    |    |    |    (M) Right Radial Line and Unit of Measurement
|    |    |    |        (see Annex C, C10), 6-7 AN
|    |    |    (M) Left Radial Line and Unit of Measurement (see Annex C, C10), 6-7 AN
|    |    (M) Cloud Radius and Unit of Measurement (see Annex C, C08), 3-4 AN
|    (M) Downwind Distance of Zone I and Unit of Measurement (see Annex C, C08), 4-5 AN
(M) Effective Wind Speed and Unit of Measurement (see Annex C, C09a.), 6 AN.
```

PAPAC **Radar Determined External Contour of Radioactive Cloud**

/-* // (* = 6)

External Contour of Radioactive Cloud, one of the following:
(M) Geographic Position, LAT/LONG, Seconds, 15 AN, or
(M) Geographic Position, UTM 10-Metre, 13 AN, or
(M) Geographic Position, LAT/LONG, Minutes, 11 AN, or
(M) Geographic Position, UTM 100-Metre, 11 AN.

Explanation of Repeatable Fields

Set PAPAC: Field 1 is repeatable to accommodate up to 6 entries in order to describe the radioactive cloud outline.

PAPAD **Radar Determined Downwind Direction of Radioactive Cloud**

/- //

(M) Downwind Direction of Radioactive Cloud and Unit of Measurement
(see Annex C, C10), 6-7 AN

Set ID

PAPAX** **Hazard Area Location for Weather Period (**=3)**

/- /-* // (* = 20)

| Hazard Area Location, one of the following:
| (M) Geographic Position, LAT/LONG, Seconds, 15 AN, or
| (M) Geographic Position, UTM 10-Metre, 13 AN, or
| (M) Geographic Position, LAT/LONG, Minutes, 11 AN, or
| (M) Geographic Position, UTM 100-Metre, 11 AN.
(M) Date-Time-Group of Start of Meteorological Period in Zulu-Time, Month and Year, 14 AN

Explanation of Repeatable Set and Field

Set PAPAX: Set is repeatable up to 3 times in order to describe three possible hazard areas corresponding to the time periods from the CDM. A hazard area for a following time period will always include the previous hazard area.

Set PAPAX: Field 2 is repeatable up to 20 times in order to describe the hazard area outline.

Note: If Hazard Area Location has only one Position, draw a circle with Radius of the (Remaining) Hazard Area Distance from set PAPAA.
If Hazard Area Location has only two Positions, these are the extreme ends of a linear attack. For each point, draw a circle with Radius of the (Remaining) Hazard Area Distance from set PAPAA and connect the circles by two tangents (see para 1212.e.).

QUEBEC* **Location of Reading/Sample/Detection and Type of Sample/Detection (* = 20)**

/- /- /- /- //

| | | ((O) Height of Measurement above Ground Level and Unit of Measurement (see Annex C, C08.), 2-7 AN
| | (M) Type of Detection (see Annex C, C25a.), 3-5 A
| (M) Type of Sample (see Annex C, C25b.), 1-5 A
Location of Reading/Sample/Detection, one of the following:
(M) Geographic Position, LAT/LONG, Seconds, 15 AN, or
(M) Geographic Position, UTM 10-Metre, 13 AN, or
(M) Geographic Position, LAT/LONG, Minutes, 11 AN, or
(M) Geographic Position, UTM 100-Metre, 11 AN.

Explanation of Repeatable Set

Set QUEBEC: Set is repeatable up to 20 times in order to describe multiple detectors, monitoring or survey points.

ROMEO* **Level of Contamination, Dose Rate Trend, and Decay Rate Trend. (* = 20)**

/- /- /- //

| | (O) Relative Decay Rate (see Annex C, C14), 2 A, or
| | (O) Actual Decay Rate, 3-4 NS.
| (O) Dose Rate Trend (see Annex C, C13), 4 A.
(M) Level of Dose Rate/Dosage and Unit of Measurement (see Annex C, C09d), 4-12 ANS, or
(M) Level of Dose and Unit of Measurement (see Annex C, C09e), 4-12 ANS, or
(M) Level of Contamination and Unit of Measurement (see Annex C, C09f), 4-12 ANS, or
(M) Miosis (see Annex C, C09g), 5A

Explanation of Repeatable Set

Set ROMEO: Set is repeatable up to 20 times in order to describe multiple detection, monitoring or survey points.

Set ID

SIERRA* **Date Time Group of Reading or Initial Detection of Contamination (* = 20)**

/- //

(M) Date-Time Group, Contamination Detected in Z-Time, Month and Year, 14 AN, or

(M) Date-Time Group of Reading in Z-Time, Month and Year, 14 AN.

Explanation of Repeatable Set

Set SIERRA: Set is repeatable up to 20 times in order to describe multiple detection, monitoring or survey points.

TANGO* **Terrain/Topography and Vegetation Description (* = 20)**

/- /- //

| (M) Vegetation Description (see Annex C, C07), 3-5 A.

(M) Terrain/Topography Description (see Annex C, C06), 3-6 A.

Explanation of Repeatable Set

Set TANGO: Set is repeatable up to 20 times in order to describe multiple detection, monitoring or survey points.

WHISKEY **Sensor information**

/- /- /- /- //

| | | (O) Assurance Level of Results, (see Annex C, C32c), 3-4 A

| | (O) Confirmatory Test (see Annex C, C32b) 1 A

| (M) Non Specific Potential Harmful Result (see Annex C, 32a) 3 A

(M) Generic Alarm Result (see Annex C, C32a) 3 A

Set WHISKEY: The format is prepared for future use. Procedures how to use it will follow later.

XRAYA** **Actual Contour Information (** = 50)**

/- /-* // (*=50)

| Limit Contour Line or Area of Contamination, one of the following:

| (M) Geographic Position, LAT/LONG, Seconds, 15 AN, or

| (M) Geographic Position, UTM 10-Metre, 13 AN, or

| (M) Geographic Position, LAT/LONG, Minutes, 11 AN, or

| (M) Geographic Position, UTM 100-Metre, 11 AN

(M) Level of Dose Rate/Dosage and Unit of Measurement (see Annex C, C09d), 4-12 ANS, or

(M) Level of Dose and Unit of Measurement (see Annex C, C09e), 4-12 ANS, or

(M) Level of Contamination and Unit of Measurement (see Annex C, C09f), 4-12ANS, or

(M) Level of Hazard (see Annex C, C09g), 3-5 AN, or

(M) Miosis (see Annex C, C09g), 5A

Explanation of Repeatable Field and Set

Set XRAYA: Field 2 is repeatable to accommodate up to 50 data entries in order to describe respective contour lines.

Set XRAYA: Set is repeatable up to 50 times to represent multiple contours.

Set ID

XRAYB		Predicted Contour Information (** = 50)**
/-	/-	/-*	// (*=50)
|	|	Limit Contour Line or Area of Contamination, one of the following:
|	|	(M) Geographic Position, LAT/LONG, Seconds, 15 AN, or
|	|	(M) Geographic Position, UTM 10-Metre, 13 AN, or
|	|	(M) Geographic Position, LAT/LONG, Minutes, 11 AN, or
|	|	(M) Geographic Position, UTM 100-Metre, 11 AN
|	(M) Level of Dose Rate/Dosage & Unit of Measurement (see Annex C, C09d) 4-12 ANS or
|	(M) Level of Dose and Unit of Measurement (see Annex C, C09e) 4-12 ANS or
|	(M) Level of Contamination and Unit of Measurement (see Annex C, C09f), 4-12ANS
|	(M) Level of Hazard (see Annex C, C09g), 3-5 AN, or
|	(M) Miosis (see Annex C, C09g), 5A
(M) Type of Contour (see Annex C, C31), 2 N

Explanation of Repeatable Field and Set
Set XRAYB:	Field 3 is repeatable to accommodate up to 50 data entries in order to describe respective contour lines.
Set XRAYB:	Set is repeatable up to 50 times to describe multiple contours or segments.

**YANKEE*		Downwind Direction and Downwind Speed (* = 20)**
/-	/-	//
|	(M) Downwind Speed and Unit of Measurement
|		(see Annex C, C09a.), 4-6 AN
(M) Downwind Direction and Unit of Measurement (see Annex C, C10), 6-7 AN

Explanation of Repeatable Set
Set YANKEE:	Set is repeatable up to 20 times in order to describe multiple detection, monitoring or survey points.

**ZULU*		Actual Weather Conditions (* = 20)**
/-	/-	/-	/-	/-	//
|	|	|	|	(M) Cloud Coverage (see Annex C, C21), 1 N
|	|	|	(M) Significant Weather Phenomena (see Annex C, C20), 1 AN
|	|	(M) Relative Humidity Range (see Annex C, C19), 1 N
|	(M) Surface Air Temperature and Unit of Measurement,
|		(see Annex C, C26 and C09c.), 2-4 ANS
(M) Detailed Air Stability Category, (see Annex C, C18b.), 1 N or
(M) Simplified Air Stability Category, (see Annex C, C18a.), 1 A.

Explanation of Repeatable Set
Set ZULU: Set is repeatable up to 20 times in order to describe multiple detection, monitoring or survey points.

**GENTEXT		General Text (unlimited free text).**
/-	/-	//
|	(M) Free Text, 1-99 X.
(M) Text Indicator, (see Annex C, C28), 1-61 X.

Note :		the text limiter 1-99 X indicates an unlimited text.

B05. NBC Meteorological Reports.

B05a. NBC Basic Wind Report (NBC BWR).

Common Message Heading (see paragraph B03.) followed by:

(M) **AREAM** (Area of Validity)

(M) **ZULUM** (Period of Validity)

(M) **UNITM** (Units of Measurement)

(M) **LAYERM** (Wind Conditions)

B05b. NBC Chemical Downwind Report (NBC CDR).

Common Message Heading (see paragraph B03.) followed by:

(M) **AREAM** (Area of Validity)

(M) **ZULUM** (Period of Validity)

(M) **UNITM** (Units of Measurement)

(M) **WHISKEYM** (Surface Weather for the first two hour Period)

(O) **XRAYM** (Surface Weather for the second two hour Period)

(O) **YANKEEM** (Surface Weather for the third two hour Period)

B05c. NBC Effective Downwind Report (NBC EDR).

Common Message Heading (see paragraph B03.) followed by:

(M) **AREAM** (Area of Validity)

(M) **ZULUM** (Period of Validity)

(M) **UNITM** (Units of Measurement)

(M) **ALFAM** (Effective Downwind for Yield Group ALFA)

(O) **BRAVOM** (Effective Downwind for Yield Group BRAVO)

(O) **CHARLIEM** (Effective Downwind for Yield Group CHARLIE)

(O) **DELTAM** (Effective Downwind for Yield Group DELTA)

(O) **ECHOM** (Effective Downwind for Yield Group ECHO)

(O) **FOXTROTM** (Effective Downwind for Yield Group FOXTROT)

(O) **GOLFM** (Effective Downwind for Yield Group GOLF)

B05d. Sets for NBC Meteorological Reports.

AREAM
/- //
(M) Name of Area of Validity, 2 - 20 X

ZULUM
/- /- /- //
| | (M) Effective Date-time in Z time, Month and Year Valid to, 14 AN
| (M) Effective Date-time in Z time, Month and Year Valid from, 14 AN
(M) Observation Date-time in Z time, Month and Year, 14 AN

UNITM
/- /- /- /- //
| | | (M) Unit of Measurement/Temperature (see Annex C, C09.c.) 1 A
| | (M) Unit of Measurement/Speed (see Annex C, C09.a.), 3 A
| (M) Unit of Measurement/Direction (see Annex C, C10), 3 A
(M) Unit of Measurement/Linear (see Annex C, C08), 1-2A

Notes : For BWR or CDR insert a dash in Field 1.
For EDR or BWR insert a dash in Field 4.

ALFAM
/- /- /- /- //
| | | (C) Angle Expansion Indicator (see Annex C, C27), 1 N
| | (C) Wind Speed, 3 N
| (C) Downwind Direction, 3 - 4 N
(O) Radius of Zone I, 3 N

Note: The units of measurement used are always indicated by set UNITM.

Explanation of Conditions:
If Field 1 is used, field 2, 3 and 4 are not used.
If Field 1 is not used, fields 2, 3 and 4 must be used.

BRAVOM through to **GOLFM** as under ALFAM above

LAYERM
/-* /- /- // (* = 15)
| | (M) Wind Speed, 3 N
| (M) Wind Direction, 3 - 4 N
(M) Layer Indicator (see Annex C, C22), 2 N

Explanation of Repeatable Field
Set LAYERM: Fields 1, 2 and 3 are repeatable to accommodate up to 15 entries for the 2km - layer wind data.

Set ID

WHISKEYM

```
/-   /-   /-   /-   /-   /-   /-   //
|    |    |    |    |    |    (M) Cloud Coverage (see Annex C, C21), 1 N
|    |    |    |    |    (M) Significant Weather Phenomena (see Annex C, C20), 1 AN
|    |    |    |    (M) Relative Humidity Range (see Annex C, C19), 1 N
|    |    |    (M) Surface Air Temperature (see Annex C, C26); 1 - 3 NS
|    |    (M) Detailed Air Stability Category (see Annex C, C18b.), 1 N, or
|    |    (M) Simplified Air Stability Category (see Annex C, C 18.a.), 1 A
|    (M) Wind Speed, 3 N
(M) Downwind Direction, 3 - 4 N
```

Note: Field 1: For variable wind enter 999 or 9999.

XRAYM Same information as under WHISKEYM above
(but for the second two hour period instead of the first)

YANKEEM Same information as under WHISKEYM above
(but for the third two hour period instead of the first)

B06. STRIKWARN.

B06a. Description of STRIKWARN.

Common Message Heading (see paragraph B03.) - but without Set NBCEVENT - followed by:

(M) **ALFAW** (STRIKWARN Target Identifier)

(M) **DELTAW** (Date-Time of Strike/Strike cancelled)

(O) **FOXONEW** (Minimum Safe Distance One)

(M) **FOXTWOW** (Minimum Safe Distance Two)

(O) **HOTELW** (Number of Surface Bursts)

(O) **INDIAW** (Number of Burst in a multiple Strike)

(M) **AKNLDG** (Acknowledge Requirement)

B06b. Sets for STRIKWARN.

Set ID

ALFAW
/- //
(M) Target Number, 1 - 10 X, or
(M) Target Nickname, 3 - 10 AN

DELTAW
/- /- //
| (M) Date-time Strike Cancelled in Z time, Month and Year, 14 AN
(M) Date-Time of Strike in Z time, Month and Year, 14 AN

Set ID

FOXONEW
/- /-* // (* = 20)
| MSD 1 Box Area, one of the following:
| (M) Geographic Position, LAT/LONG, Seconds, 15 AN, or
| (M) Geographic Position, UTM 10-Metre, 13 AN, or
| (M) Geographic Position, LAT/LONG, Minutes, 11 AN, or
| (M) Geographic Position, UTM 100-Metre, 11 AN
(M) Minimum Safe Distance 1 in Hundreds of Metres, 3 N

FOXTWOW
/- /-* // (*=20)
| MSD 2 Box Area, one of the following:
| (M) Geographic Position, LAT/LONG, Seconds, 15 AN, or
| (M) Geographic Position, UTM 10-Metre, 13 AN, or
| (M) Geographic Position, LAT/LONG, Minutes, 11 AN, or
| (M) Geographic Position, UTM 100-Metre, 11 AN
(M) Minimum Safe Distance 2 in Hundreds of Metres, 3 N

HOTELW
/- //
(M) Number of Surface Bursts, 5 - 6 AN

INDIAW
/- //
(M) Number of Bursts in a Multiple Strike, 1 - 3 N

AKNLDG
/- /- //
| (O) Instructions for Acknowledging, 1 - 50 X
| (O) Force or Unit required to Acknowledge, 1 - 30 X
(M) Acknowledge Requirement Indicator. (YES or NO), 2 - 3 A

B07. Strike Serial Number (SSN)

```
ALFA                        Strike Serial Number (SSN)
/-    /-    /-    /-    /-    //
|     |     |     |     (O) Grading of Message, 1-3 N.
|     |     |     (M) N, B, C, RN , RB , RC or RU  as explained below, 1-2 A.
|     |     (M) Sequence Number, 10 X.
|     (M) Code for Originator, 1-6  X.
(M) Nationality, 2 A or
(M) Area Control Centre Code, 2-3 AN.
```

Field 1:

a. This field can only be used by an agency (Area Control Centre) responsible for an Area of Observation in accordance with the definitions in the GLOSSARY. This can be a national or a multinational Area Control Centre (ACC) as defined in NATO and national SOPs.

b. Field 1 will then contain a symbol for this ACC (e.g. the NATO abbreviation for that nation).

c. ACCs must be specified for all operational areas.

d. If an organisation is established in an operational area for which there is no specified Area of Observation, that organisation may (in accordance with the threat) establish one or more Areas of Observation and allocate these to commands who will have the ACC responsibility for each area. In such cases the qualifier will be established at the same time.

e. When the qualifier is used it indicates that the message has been evaluated, correlated, and approved and is considered as the validated report on a NBC incident, and the SSN will be known as an Official Strike Serial Number (OSSN).

f. Otherwise (e.g. when originated by other units) field 1 is left unused as indicated by /-/, and the SSN will be known as a Local Strike Serial Number (LSSN)

Field 2:

a. This field will be used by the originator of the message.

b. It will contain an indicator identifying the originator of the report. This is the agency (NBC Centre) which creates the message.

c. Individual SOPs must define how to use this field.

d. To indicate the retransmitting agency the set MSGID explained in para B02 is used.

Field 3:

a. This field will contain the incident sequence number assigned by the originator listed in field 2.

b. A separate sequence may or may not be used for each of the incident types listed in field 4. However, NATO or national SOPs must define how to use this field.

Field 4:

This field will contain letters N, B, C, RN, RB, RC or RU depending on the type of incident:

N for NUC attacks.
B for BIO attacks.
C for CHEM attacks.
RN for Nuclear releases other than attacks.
RB for Biological releases other than attacks.
RC for Chemical releases other than attacks.
RU for unidentified releases other than attacks.

Field 5:

This field will contain the grading of the message as explained in AEP-45 Appendix D-28. Normally for NBC 2 NUC only.

ANNEX C

LEGAL ENTRIES FOR ADP USE

C01. General

This annex describes the legal entries. The codes and definitions listed below, which must be used in ADP messages, should also be used in manually produced NBC messages. In all mandatory fields a hyphen must be entered if no information is known.

C02. Type of Persistency

P	Persistent
NP	Non-persistent
T	Thickened
UNK	Unknown

C03. Agent

C03a. Type of Agent

Nuclear		Biological		Chemical	
NIL	No agent detected (only used in NBC4)	**BIO**	Biological	**BL**	Blister agent
OTR	Other agent	**NIL**	No agent detected (only used in NBC4)	**BLOD**	Blood agent
RNP	ROTA nuclear power plant	**OTR**	Other agent	**CHOK**	Choking agent
TIM	Toxic Industrial Material	TIM	Toxic Industrial Material	**G**	G agent
UNK	Unknown	**TOX**	Toxin	**H**	Mustard agent
		UNK	Unknown	**INCP**	Incapaciting agent
		BAC	Bacterial	**IRT**	Irritant
		CLA	Chlamydia	**NERV**	Nerve agent
		RIC	Rickettsiae	**NIL**	No agent detected (only used in NBC4)
		VIR	Viral	**OTR**	Other agent
				PENT	Penetrating agent
				TIM	Toxic Industrial Material
				UNK	Unknown
				V	V-agent
				VMT	Vomiting agent

Note 1) The entry ALL may be used in a NBC 4 with a OSSN to indicate that the attack is not longer in effect. See explanation in AEP-45, D-1210.b(2). and D-1801.d.
Note 2) If OTR, include any details available in set GENTEXT

C03b. Agent Name

Nuclear		Biological		Chemical	
ALP	Alpha			**AC**	Hydrogen cyanide
BETA	Beta			**BZ**	Quinuclidinyl benzilate
GAM	Gamma			**CG**	Phosgene
NEU	Neutron			**CK**	Cyanogen chloride
COB	Cobalt-60			**CX**	Phosgene oxime
CES	Cesium-137			**DP**	Di-Phosgene
FF	Fresh Reactor Fuel			**GA**	Tabun
FL	Nuclear Weapon Fallout			**GB**	Sarin
				GD	Soman
IO	Iodine			**GF**	Cyclo-Sarin
OF	Spent Reactor Fuel			**HD**	Mustard distilled
PU	Plutonium			**HL**	Mustard-Lewisite
				HN	Nitrogen mustard
				HT	Trimeric mustard
				L	Lewisite
				PS	Chloropicrin
				SA	Arsin
				TG	Tear gas
				VX	VX

If Biological Agent Identity is known, enter in set GENTEXT.

C03c. UN/NA Identification Number. (used for ROTA only)

A four digit Number taken from the Emergency Response Guidebook.

C04. Delivery

C04a. Delivery System Type

AIR	Aircraft
BOM	Bomb (delivering Bomblets only)
CAN	Cannon
MLR	Multiple Launched Rocket System
MSL	Missile
MOR	Mortar
PLT	Plant
RLD	Railroad Car
SHP	Ship
TPT	Transport
UNK	Unknown

C04b. Agent Container Type

BML	Bomblets
BOM	Bomb
BTL	Pressurised Gas Bottle
BUK	Bunker
CON	Generic Storage Container
DRM	Nominal 200 litre Storage Drum
GEN	Generator (Aerosol)
MSL	Missile
RCT	Reactor
RKT	Rocket
SHL	Shell
SPR	Spray (tank)
STK	Stockpile
TNK	Storage Tank
TOR	Torpedo
MNE	Mine (NBC filled only)
UNK	Unknown
WST	Waste

C04c. Size of Spill or Release (ROTA)

SML	Small (Less than 200 Litres or 200 KG)
LRG	Large
XLG	Extra Large (Greater than 1500 Litres or 1500 KG)
UNK	Unknown

C05. Suspected/Observed

SUS	Suspected
OBS	Observed

C06. Terrain/Topography Description

FLAT	Flat
URBAN	Urban
HILL	Hill
SEA	Sea
VALLEY	Valley
UNK	Unknown

C07. Vegetation Description.

BARE	Bare
SCRUB	Scrubby Vegetation
WOODS	Wooded Terrain
URBAN	Urban
UNK	Unknown

C08. Unit of Measurement, Length and Height

KM	Kilometres
NM	Nautical Miles
FT	Feet
KF	Kilofeet (1000 feet)
HM	Hectometres (100 metres)
YD	Yards
M	Metres
SM	Statute Miles

C09. Units of Measurement

C09a. Unit of Measurement, Speed

MPS	Metres per Second
KPH	Kilometres per Hour
KTS	Knots
MPH	Miles per Hour

C09b. Unit of Measurement, Time

DAY	Days
HR	Hours
MIN	Minutes
SEC	Seconds
WK	Weeks
MON	Month

C09c. Unit of Measurement, Temperature

C	Celsius
F	Fahrenheit

C09d. Unit of Measurement, Dose Rate/Dosage

CGH	Centigray per hour
CSH	Centisievert per hour
MSH	Millisievert per hour
USH	Microsievert per hour
BQS	Becquerel
MM3	Milligram-minutes per cubic meter

C09e. Unit of Measurement, Dose

CFU	Colony forming units
CGY	Centigray
CSV	Centisievert
MGY	Milligray
MSV	Millisievert
USV	Microsievert

C09f. Unit of Measurement, Contamination

ACPL	Agent containing particles per litre
BQM2	Becquerel per square meter
BQM3	Becquerel per cubic meter
MGM2	Milligrams per square meter
MGM3	Milligrams per cubic meter
PPM	Parts per Million (10^6)
PPB	Parts per Billion (10^9)

C09g. Lethal or Incapacitating Dose/Dosage Percentage

LDXX	Lethal Dose xx = LD_1 to LD_{99}
IDXX	Incapacitating Dose xx = ID_1 to ID_{99}
ICTXX	Incapacitating Dosage xx = ICt_1 to ICt_{99}
LCTXX	Lethal Dosage xx = LCt_1 to LCt_{99}
MCTXX	Eye effecting Dosage xx (Miosis) = MCt_1 to MCt_{99}

C10. Unit of Measurement, Direction

DGM	Degrees/Magnetic North
DGT	Degrees/True North
DGG	Degrees/Grid North
MLM	Mils/Magnetic North
MLT	Mils/True North
MLG	Mils/Grid North

C11. Unit of Measurement, Angle

MIL	Mils
DEG	Degrees

C12. Type of Nuclear Burst or Agent Release Height

AIR	Air
SURF	Surface (release on ground impact)
SUBS	Sub surface (SUBS is only used in NUC reports)
UNK	Unknown

C13. Dose Rate Trends/Decay Rates

BACK	Background
DECR	Decreasing
INCR	Increasing
INIT	Initial
SAME	Same
PEAK	Peak

C14. Relative Decay Rates

DN	Decay Normal
DF	Decay Faster than Normal
DS	Decay Slower than Normal

C15. Message Text Format Identifier

NBCSITREP	NBC Situation Report
NUC1	NBC1 NUC Report
NUC2	NBC2 NUC Report
NUC3	NBC3 NUC Report
NUC4	NBC4 NUC Report
NUC5	NBC5 NUC Report
NUC6	NBC6 NUC Report
BIOCHEM1	NBC1 BIO or CHEM Report
BIOCHEM2	NBC2 BIO or CHEM Report
BIOCHEM3	NBC3 BIO or CHEM Report
BIOCHEM4	NBC4 BIO or CHEM Report
BIOCHEM5	NBC5 BIO or CHEM Report
BIOCHEM6	NBC6 BIO or CHEM Report
ROTA1	NBC1 ROTA Report
ROTA2	NBC2 ROTA Report
ROTA3	NBC3 ROTA Report
ROTA4	NBC4 ROTA Report
ROTA5	NBC5 ROTA Report
ROTA6	NBC6 ROTA Report
BWR	NBC Basic Wind Report
EDR	NBC Effective Downwind Report
CDR	NBC Chemical Downwind Report
STRIKWARN	NBC Nuclear Strike Warning Message

C16. Type of NBC Report

C16a. Type of NBC Report (Event)

NUC	Nuclear Report
BIO	Biological Report
CHEM	Chemical Report
ROTA	ROTA Report
UNK	Unknown
WARN	ROTA Warning (for use in ROTA Warning Message from STANAG 2229)

C16b. Type of NBC Weather Report

BWM	NBC Basic Wind Data Message
BWF	NBC Basic Wind Data Forecast
EDM	NBC Effective Downwind Message
EDF	NBC Effective Downwind Forecast
CDM	NBC Chemical Downwind Message
CDF	NBC Chemical Downwind Forecast

C16c. Type of Incident

N	Nuclear Attack
B	Biological Attack
C	Chemical Attack
RN	Nuclear ROTA
RB	Biological ROTA
RC	Chemical ROTA
RU	Unidentified ROTA

C17. Location Qualifier

AA	Actual Location
EE	Estimated Location

C18. Air Stability Categories

C18a. Simplified

U	Unstable
N	Neutral
S	Stable

C18b. Detailed

1	Very Unstable
2	Unstable
3	Slightly Unstable
4	Neutral
5	Slightly Stable
6	Stable
7	Very Stable

C19. Relative Humidity Range

0	0 - 9 Percent
1	10 - 19 Percent
2	20 - 29 Percent
3	30 - 39 Percent
4	40 - 49 Percent
5	50 - 59 Percent
6	60 - 69 Percent
7	70 - 79 Percent
8	80 - 89 Percent
9	90 - 100 Percent

C20. Significant Weather Phenomena

0	No Significant Weather Phenomena
1	Sea Breeze
2	Land Breeze
3	Blowing Snow, Sand Storm, Dust Storm
4	Fog, Ice Fog, Thick Haze (visibility less than 4 km)
5	Drizzle
6	Rain
7	Snow, Rain, Snow mixed (no shower)
8	Showers of Rain, Snow, Rain and Snow mixed, Hail
9	Thunderstorm with or without Precipitation
A	Top of inversion layer lower than 800 M
B	Top of inversion layer lower than 400 M
C	Top of inversion layer lower than 200 M

C21. Cloud Coverage.

0	Less than half covered (scattered)
1	More than half covered (broken)
2	Completely covered (overcast)
3	No Clouds (clear conditions)

C22. Layer Indicator

02	2000 Metres
04	4000 Metres (in increments of 2000 Metres)
30	30000 Metres

C23. Crater Indicator

CRATER	Crater present
NONE	No crater present
UNK	Unknown

C24. Cloud Section

TOP	Cloud Top
BOT	Cloud bottom

C25. Type of Detection and Sample

C25.a.Type of Detection

OTH	Other (use GENTEXT to specify)
MPDS	Manned Point Detection System
UMPDS	Un- Manned Point Detection System
MSDS	Manned Stand-off Detection System
UMSDS	Un-Manned Stand-off Detection System
MSVY	Manned Survey
UMSVY	Un- Manned Survey

C25.b. Type of Sample

LIQ	Liquid sample
VAP	Vapour
SOIL	Soil Sample
SOLID	Solid Sample
VEG	Vegetation Sample
WATER	Water Sample

C26. Air Temperature

- 99	Minus 99 degrees
- 98	Minus 98 degrees

-51	Minus 51 degrees
-50	Minus 50 degrees
-49	Minus 49 degrees

-01	Minus 1 degree
00	0 degrees
01	Plus 1 degree

49	Plus 49 degrees

999	Plus 999 degrees

C27. Angle Expansion Indicator

4	40 degrees
5	50 degrees
6	60 degrees
7	70 degrees
8	80 degrees
9	90 degrees
0	100 degrees
1	110 degrees
2	120 degrees
3	More than 120 degrees

C28. Text Indicator

NBCINFO	for NBC 1-6
NBC SITREP	for NBC Situation Report

C29. ROTA Event Description

CLOUD	Visible Cloud
FIRE	Burning Fire
POOL	Large Quantity of Still Liquid
LEAK	Continuous Flow from Damaged Pipe or Container
SPILL	Small Quantity of Still Liquid
LIQUID	Liquid

C30. ROTA Event Status

PUFF	Single Release of a Cloud
CONT	Continuous
SPRAY	Spraying

C31. Type of Contour

01 through 99	Probability in percent terms of exceeding value in field 2 of Set XRAYB

C32. Sensor Results

C32.a.Generic Alarm Results

POS	Positive Results
NEG	Negative Results

C32.b. Confirmatory Test

Y	Yes, Conducted
N	No, Not Conducted

C32.c.Confidence Level of Results

LOW	Low Confidence
MED	Medium Confidence
HIGH	High Confidence

These legal entries are prepared for future use. Procedures on how to use them will follow later.

ANNEX D

FORMATTING OF NBC MESSAGES MESSAGES, SETS AND OCCURRENCE MATRICES (RELATED TO ADatP-3)

D01. General

a. The ADP NBC messages must be formatted to ensure consistency with the manually formatted messages, thereby making messages easy to be read and understood by NBC experts or specialists. In addition computerised systems should use the same formatting rules so that systems are made compatible.

b. It is mandatory that the formatting is made consistent with the rules and procedures laid down in STANAG 5500, Part I, and that the NBC Message Text Formats reside inside the NATO ADatP-3 Data Base. The rules in this document may in some cases be more restricted but still reside inside ADatP-3 Data Base.

c. Teletype NBC weather messages are formatted in accordance with meteorological regulations. These messages have to be reformatted upon entry into an NBC ADP system in accordance with the rules in AEP-45, Annex B and C.

d. The prescribed message formats do not address those items which are governed by message protocol, i.e. Message Precedence, Message Classification, Addresses, Date-Time Group etc (see AEP-45, Annex D, Appendix D-25 for details).

D02. The Use of Letters (Sets) in ADP Formatted NBC Messages

An ADP system requires information to be entered in specific ways to enable processing to be completed. This is slightly at variance with the manual system. The manual system, for example, allows any letter item to be inserted in any message. Entering information in an ADP system is controlled by several occurrence matrices. Each occurrence matrix shows the relationship between mandatory, operationally determined and conditional set identifiers and the NBC messages. These matrices are at para D05. Additional letter items can be inserted in this ADP system by using the GENTEXT, thus making it possible to complete the same tasks as in the manual system. Occurrence categories are defined as follows:

a. **Mandatory (M)**
The categorisation of the occurrence of those sets formats and field formats, which are related to essential information.

Note: These are the minimum numbers of information items absolutely necessary to complete message processing. If information for a mandatory field is not available, a hyphen (-) must be entered into that field.

b. **Operationally Determined (O)**
The categorisation of the occurrence of those set formats and field formats, which are determined only by operational considerations.

Note: If Information for these sets and fields is available it should be entered, but it is not essential for message processing.

c. **Conditional (C)**
The categorisation of the occurrence of those set formats and field formats, the treatment of which depends on the status of specified conditions.

D03. Legal Entries

In the manual system variation in spelling and abbreviations are acceptable and will not affect the transmission of messages. If the correct legal entries are not used in an ADP system message processing cannot take place. The legal entries are defined and required among others for the following information:

- Persistency indicator,
- agent type,
- air stability category, and
- type of nuclear burst.

A complete list of legal entries is at Annex C.

D04. Occurrence Matrix

a. Para D05 contains the occurrence matrices as described in para D02. The message types are listed as column headings while the set identifiers are listed vertically. The contents of the matrix show which sets are used in each message.

b. The letters M, O, and C indicate Mandatory, Operationally Determined and Conditional. See para D02 for definitions of these occurrence categories.

c. Explanations of message and set abbreviations are given in Annex B.

D05. Occurrence Categories for SETS in MESSAGES and REPORTS

D05.a. Occurrence Matrix for Common Message Heading

	NBC 1			NBC 2			NBC 3			NBC 4			NBC 5			NBC 6		
	N	B/C	R	N	B/C	R	N	B/C	R	N	B/C	R	N	B/C	R	N	B/C	R
EXER	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
OPER	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C	C
MSGID	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
REF	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O	O
GEODATUM	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	C	C	C
DTG	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
ORGIDDFT	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
NBCEVENT	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M

	STRIK WARN	NBC BWR	NBC EDR	NBC CDR	NBC SITREP
EXER	O	O	O	O	O
OPER	C	C	C	C	C
MSGID	M	M	M	M	M
REF	O	O	O	O	O
GEODATUM	M				
DTG	M	M	M	M	M
ORGIDDFT	M	M	M	M	M
NBCEVENT		M	M	M	

D05.b. Occurrence Matrix for NBC Meteorological Reports

	NBC BWR	NBC EDR	NBC CDR
AREAM	M	M	M
ZULUM	M	M	M
UNITM	M	M	M
LAYERM	M		
ALFAM		M	
BRAVOM		O	
CHARLIEM		O	
DELTAM		O	
FOXTROTM		O	
GOLFM		O	
WHISKEYM			M
XRAYM			O
YANKEEM			O

D05.c. Occurrence Matrix for NBC1 - 6 and NBCSITREP

	NBC 1			NBC 2			NBC 3			NBC 4			NBC 5			NBC 6			NBC
	N	B/C	R	N	B/C	R	N	B/C	R	N	B/C	R	N	B/C	R	N	B/C	R	SITREP
ALFA	**O**	C	**O**	**M**	**M**	**M**	**M**	**M**	**M**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	
BRAVO	**M**	**M**	**M**																
CHARLIE			**M**			**M**			**M**						**O**			**O**	
DELTA	**M**	**M**		**M**	**M**		**M**	**M**					**O**	**O**		**O**	**O**		
FOXTROT	**O**	**O**	**O**	**M**	**M**	**M**	**M**	**M**	**M**							**O**	**O**	**O**	
GOLF	**M**	**M**	**M**	**M**	**M**	**M**	**O**	**O**	**O**										
HOTEL	**M**			**M**			**O**												
INDIA		**M**	**M**		**M**	**M**		**M**	**M**		**M**	**M**		**M**	**M**	**O**	**O**	**O**	
JULIET	**O**																		
KILO										**O**									
LIMA	**O**																		
MIKE	**O**																		
MIKER			**O**			**M**			**O**										
NOVEMBER				**M**			**O**												
OSCAR							**O**	**O**	**O**				**M**	**M**	**M**				
PAPAA								**M**	**M**										
PAPAB							**M**												
PAPAC	**O**						**O**												
PAPAD	**O**						**O**												
PAPAX								**M**	**M**										
QUEBEC										**M**	**M**	**M**				**O**	**O**	**O**	
ROMEO										**M**	**O**	**O**				**O**	**O**	**O**	
SIERRA										**M**	**M**	**M**				**O**	**O**	**O**	
TANGO		**M**	**M**		**M**	**M**		**O**	**O**	**O**	**M**	**M**		**O**	**O**				
WHISKEY										**O**	**O**	**O**							
XRAYA													**M**	**M**	**M**				
XRAYB							**C**	**C**	**C**				**O**	**O**	**O**				
YANKEE	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**				
ZULU	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**				
GENTEXT	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**O**	**M**	**M**	**M**	**M**

D05.d. Occurrence Matrix for STRIKWARN

	STRIKWARN
ALFAW	**M**
DELTAW	**M**
FOXONEW	**O**
FOXTWOW	**M**
HOTELW	**O**
INDIAW	**O**
AKNLDG	**M**

D06. Explanation of Conditional Sets

Annex B contains all the sets required for the content of all NBC-Reports and does not discriminate by type. An ADP system will present to the operator only those sets required according to the NBC event selected. Subsequent conditionalities will now only be related to the NBC event selected.

a. Common Message Heading
Set EXER and OPER are mutually exclusive.

b. Set GEODATUM in NBC 6 becomes (M) if set FOXTROT or set QUEBEC is used.

c. Set ALFA in NBC 1 is prohibited if field 1 of set NBCEVENT is UNK.

d. Set XRAYB in NBC 3 is prohibited if set OSCAR does not occur.

D07. Explanation of Segments

Set QUEBEC, ROMEO, SIERRA and TANGO are a Segment

a) In a NBC 4 NUC set QUEBEC, ROMEO and SIERRA are mandatory (M). If there is a repetition, the whole segment has to be repeated. Set QUEBEC is not allowed to be repeated before set ROMEO and SIERRA appeared.
Set TANGO is operationally determined (O). This set might or might not be included into the segment.

b) In a NBC 4 BIO or CHEM set QUEBEC, SIERRA and TANGO are mandatory (M). If there is a repetition, the whole segment has to be repeated. Set QUEBEC is not allowed to be repeated before set SIERRA and TANGO appeared.
Set ROMEO is operationally determined (O). This set might or might not be included into the segment.

c) In a NBC 6 set QUEBEC, ROMEO and SIERRA are operationally determined (O). If there is a repetition, the whole segment should be repeated.

ANNEX E

PREDICTING CHEMICAL HAZARD AREAS TABLES, GRAPHS ETC.

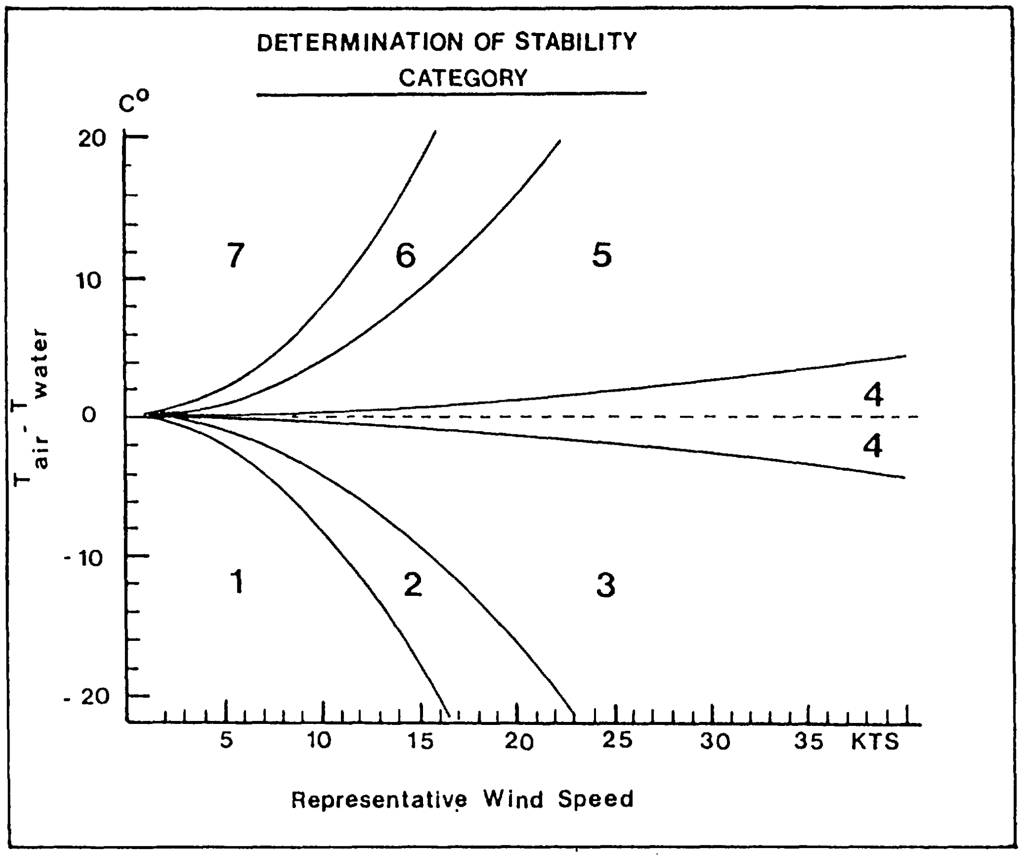


Figure E-I, Graph for Determination of Air Stability Category (SEA).

Note: The numbers 1 through 7 in the above graph refer to the seven stability categories as described in Annex C.

CDM (ADP formatted)
EXER/CC92//
MSGID/EDR/FLKDOGEOPHYSBLSTN/003/JUN//
AREAM/NFEA//
ZULUM/110400Z/110600ZJUN93/111200ZJUN93//
UNITM/-/DGT/KTS/C//
WHISKEYM/030/005/1/14/7/0/-//
XRAYM/040/010/3/15/6/6/-//
YANKEEM/070/012/4/16/6/6/-//

CHEMICAL PREDICTION SHEET				
Agent:	**Sarin**			
Delivery Means:	**Artillery**			
Hazard Level:	**ICt5**			
1	NBC CENTRE: AMZ BSN			
2	AREA OF VALIDITY: NFEA			
3	ORIGINATOR OF CDM: F1Kdo/GEOPHYS B1St N			
4	DATE: 11 JUN	**PERIOD**		
5	TIME OF VALIDITY: 0600Z - 1200Z	**W**	**X**	**Y**
6	Downwind Direction (Degrees)	030	040	070
7	Downwind Speed 10 m (KTS)	5	10	12
8	1.5 times the Wind Speed (KTS)	7.5	15	18
9	.5 times the Wind Speed (KTS)	2.5	5	6
10	Stability Category	1	3	4
11	Temperature (Centigrade)	14	15	16
12	Relative Humidity (Percent)	70	60	60
13	Significant Weather Phenomena	-	RAIN	RAIN
14	Cloud Coverage	-	-	-
15	Maximum Downwind Hazard Distance (NM)	4	6	6
16	Maximum Duration of Hazard (Hours)	1,5	1.2	1.0
17	Half Sector Angle (Degrees)	CIRCULAR	20	20
18	Remarks			

Figure E-II,
Example Chemical Downwind Message and Chemical Prediction Data Sheet (CPDS)

DOWNWIND HAZARD DISTANCE (KILOMETERS) "LAND"

Agent : SARIN
Weapon ARTILLERY (CANNON/MORTAR)
Eff. Payload 650 kg

Agent : SOMAN
Weapon : ROCKET/MISSILE
Eff. Payload : 250 kg

STABILITY	1	2	3	4	5	6	7	DOSE	STABILITY	1	2	3	4	5	6	7	DOSE
WIND	<1	<1	<1	<1	<1	5	5	LCt50	WIND	<1	<1	<1	<1	<1	<1	<1	LCt50
11 – 17	5	5	10	10	15	15	15	ICt5	11 – 17	<1	5	5	5	10	10	10	ICt5
KMH	5	10	10	15	20	25	20	MIOSIS	KMH	5	5	5	10	10	15	10	MIOSIS
WIND	<1	<1	<1	<1	<1	<1		LCt50	WIND	<1	<1	<1	<1	<1	<1		LCt50
18 – 26	5	5	5	10	15	20		ICt5	18 – 26	<1	5	5	5	5	10		ICt5
KMH	5	5	10	15	20	25		MIOSIS	KMH	5	5	5	5	10	15		MIOSIS
WIND		<1	<1	<1	<1			LCt50	WIND		<1	<1	<1	<1			LCt50
27 – 36		5	5	10	10			ICt5	27 – 36		<1	5	5	5			ICt5
KMH		5	10	10	15			MIOSIS	KMH		5	5	5	10			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			<1	<1	<1			LCt50
37 – 45			5	5	10			ICt5	37 – 45			<1	5	5			ICt5
KMH			5	10	15			MIOSIS	KMH			5	5	5			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			<1	<1	<1			LCt50
46 – 54			5	5	10			ICt5	46 – 54			<1	5	5			ICt5
KMH			5	10	15			MIOSIS	KMH			5	5	5			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			<1	<1	<1			LCt50
55 – 63			5	5	5			ICt5	55 – 63			<1	5	5			ICt5
KMH			5	10	10			MIOSIS	KMH			5	5	5			MIOSIS

Table E - I,
Downwind Hazard Distance versus Wind Speed (KM/H) and Air Stability, LAND.

Agent : SARIN
Weapon : BOMBS (6)
Eff. Payload : 600 kg

Agent : SARIN
Weapon : Multiple Launched Rocket System
Eff. Payload : 3500 kg

STABILITY	1	2	3	4	5	6	7	DOSE	STABILITY	1	2	3	4	5	6	7	DOSE
WIND	<1	<1	<1	<1	<1	<1	5	LCt50	WIND	<1	5	5	5	10	10	10	LCt50
11 – 17	5	5	10	10	15	15	15	ICt5	11 – 17	10	20	25	40	50	45	35	ICt5
KMH	5	10	10	15	20	20	20	MIOSIS	KMH	15	25	40	55	65	60	45	MIOSIS
WIND	<1	<1	<1	<1	<1	<1		LCt50	WIND	<1	5	5	5	5	10		LCt50
18 – 26	5	5	5	10	15	15		ICt5	18 – 26	10	15	25	35	50	55		ICt5
KMH	5	5	10	15	20	25		MIOSIS	KMH	15	20	35	50	70	75		MIOSIS
WIND		<1	<1	<1	<1			LCt50	WIND		<1	5	5	5			LCt50
27 – 36		5	5	10	10			ICt5	27 – 36		10	20	30	40			ICt5
KMH		5	10	10	15			MIOSIS	KMH		15	25	40	60			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			<1	5	5			LCt50
37 – 45			5	5	10			ICt5	37 – 45			15	25	35			ICt5
KMH			5	10	15			MIOSIS	KMH			25	35	55			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			<1	5	5			LCt50
46 – 54			5	5	10			ICt5	46 – 54			15	20	30			ICt5
KMH			5	10	10			MIOSIS	KMH			20	30	45			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			<1	5	5			LCt50
55 – 63			5	5	5			ICt5	55 – 63			10	20	30			ICt5
KMH			5	5	10			MIOSIS	KMH			20	25	40			MIOSIS

Table E - II,
Downwind Hazard Distance versus Wind Speed (KM/H) and Air Stability, LAND

DOWNWIND HAZARD DISTANCE (NAUTICAL MILES) "SEA"

Agent	: SARIN	Agent	: SOMAN
Weapon	: ARTILLERY (CANNON/MORTAR)	Weapon	: ROCKET/MISSILE
Eff. Payload	: 650 kg	Eff. Payload	: 250 kg

STABILITY	1	2	3	4	5	6	7	DOSE	STABILITY	1	2	3	4	5	6	7	DOSE
WIND	<1	<1	<1	<1	<1	2	2	LCt50	WIND	<1	<1	<1	<1	<1	<1	<1	LCt50
5 – 9	4	4	6	8	8	10	8	ICt5	5 –9	2	2	2	4	4	4	4	ICt5
KTS	4	6	8	10	12	12	12	MIOSIS	KTS	2	4	4	4	6	6	6	MIOSIS
WIND	<1	<1	<1	<1	<1	2		LCt50	WIND	<1	<1	<1	<1	<1	<1		LCt50
10 – 14	2	4	6	6	8	10		ICt5	10 – 14	2	2	2	2	4	4		ICt5
KTS	4	6	8	10	12	14		MIOSIS	KTS	2	2	4	4	6	8		MIOSIS
WIND		<1	<1	<1	<1			LCt50	WIND		<1	<1	<1	<1			LCt50
15 – 19		2	4	6	6			ICt5	15 – 19		2	2	2	2			ICt5
KTS		4	6	8	10			MIOSIS	KTS		2	2	4	4			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			<1	<1	<1			LCt50
20 – 24			4	4	6			ICt5	20 – 24			2	2	2			ICt5
KTS			4	6	8			MIOSIS	KTS			2	2	4			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			<1	<1	<1			LCt50
25 – 29			2	4	4			ICt5	25 – 29			2	2	2			ICt5
KTS			4	6	8			MIOSIS	KTS			2	2	4			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			<1	<1	<1			LCt50
30 – 34			2	4	4			ICt5	30 – 34			2	2	2			ICt5
KTS			4	4	6			MIOSIS	KTS			2	2	2			MIOSIS

Table E - III,
Downwind Hazard Distance versus Wind Speed (KTS) and Air Stability, SEA

Agent	: SARIN	Agent	: SARIN
Weapon	: BOMBS (6)	Weapon	: Multiple Launched Rocket System
Eff. Payload	: 600 kg	Eff. Payload	: 3500 kg

STABILITY	1	2	3	4	5	6	7	DOSE	STABILITY	1	2	3	4	5	6	7	DOSE
WIND	<1	<1	<1	<1	<1	2	2	LCt50	WIND	2	2	2	4	4	4	4	LCt50
5 – 9	4	4	6	6	8	8	8	ICt5	5 – 9	12	16	20	26	28	26	20	ICt5
KTS	4	6	8	10	12	12	10	MIOSIS	KTS	16	22	30	36	38	34	26	MIOSIS
WIND	<1	<1	<1	<1	<1	2		LCt50	WIND	2	2	2	2	4	4		LCt50
10 – 14	2	4	4	6	8	10		ICt5	10 – 14	10	14	20	26	30	32		ICt5
KTS	4	6	8	10	12	14		MIOSIS	KTS	16	20	28	38	44	42		MIOSIS
WIND		<1	<1	<1	<1			LCt50	WIND		2	2	2	2			LCt50
15 – 19		2	4	4	6			ICt5	15 – 19		10	16	20	26			ICt5
KTS		4	6	8	10			MIOSIS	KTS		16	22	30	38			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			2	2	2			LCt50
20 – 24			2	4	6			ICt5	20 – 24			12	18	22			ICt5
KTS			4	6	8			MIOSIS	KTS			18	26	34			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			2	2	2			LCt50
25 – 29			2	4	4			ICt5	25 – 29			10	14	20			ICt5
KTS			4	6	6			MIOSIS	KTS			16	22	30			MIOSIS
WIND			<1	<1	<1			LCt50	WIND			2	2	2			LCt50
30 – 34			2	2	4			ICt5	30 – 34			10	12	18			ICt5
KTS			4	4	6			MIOSIS	KTS			14	20	28			MIOSIS

Table E - IV,
Downwind Hazard Distance versus Wind Speed (KTS) and Air Stability, SEA.

ANNEX F

AREAS OF VALIDITY FOR NBC METEOROLOGICAL DATA

F01. Purpose

The purpose of this Annex F is to delineate the areas of validity for NBC meteorological information.

F02. Explanation

The grid is developed as follows:

a. The latitudinal bands have a width of 10°.

b. The longitudinal sectors have a width of 10°.

c. Each quadrangle created by the intersection of a band and a sector is designated by 4 alphabetic letters. The nomenclature is developed as follows:

(1) Beginning at the equator on the northern hemisphere the bands are labelled with an N (North) followed by an alphabetical letter (I intentionally omitted) in ascending order to the North.

(2) Beginning at the equator on the southern hemisphere the bands are labelled with an S (South) followed by an alphabetical letter (I intentionally omitted) in ascending order to the south.

(3) Beginning with the sector east of the Greenwich meridian the sectors are labelled with an E (East) followed by an alphabetical letter (I and O are intentionally omitted) in ascending order towards the East.

(4) Beginning with the sector West of the Greenwich meridian the sectors are labelled with a W (West) followed by an alphabetical letter (I and O are intentionally omitted) in ascending order towards the West.

d. An area is then defined by the label of the band followed by the label of the sector. Thus all areas on the northern hemisphere begin with an N, while those on the southern hemisphere begin with an S.

e. These rather large areas of validity can be subdivided repeatedly to allow for higher precision by applying the following procedure as shown in Figure F-I for the quadrangle marked with a dot:

(1) The current quadrangle is subdivided into four sub quadrangles by using one half of the current sector and band width respectively.

(2) The four sub quadrangles are numbered clockwise from 1 to 4, beginning with the Northeast sub quadrangle.

(3) The number of the sub quadrangle to be referred to is appended to the current reference.

f. This procedure can be repeated to define even smaller areas by adding further digits in the same manner. In the example only two subdivisions were carried out to define a quadrangle referenced as NDEL13 of 2.5° x 2.5°. A diagram for the southern hemisphere is shown in Figure F-II.

g. All quadrangles must face north in order to have the sub quadrangles numbered the same way on both the northern and the southern hemispheres.

F03. Provision of Meteorological Data for Out of Area Operations

For out of Area operations the appropriate weather agency will be identified and tasked by SHAPE to provide the weather data.

AREAS of VALIDITY for the NORTHERN HEMISPHERE

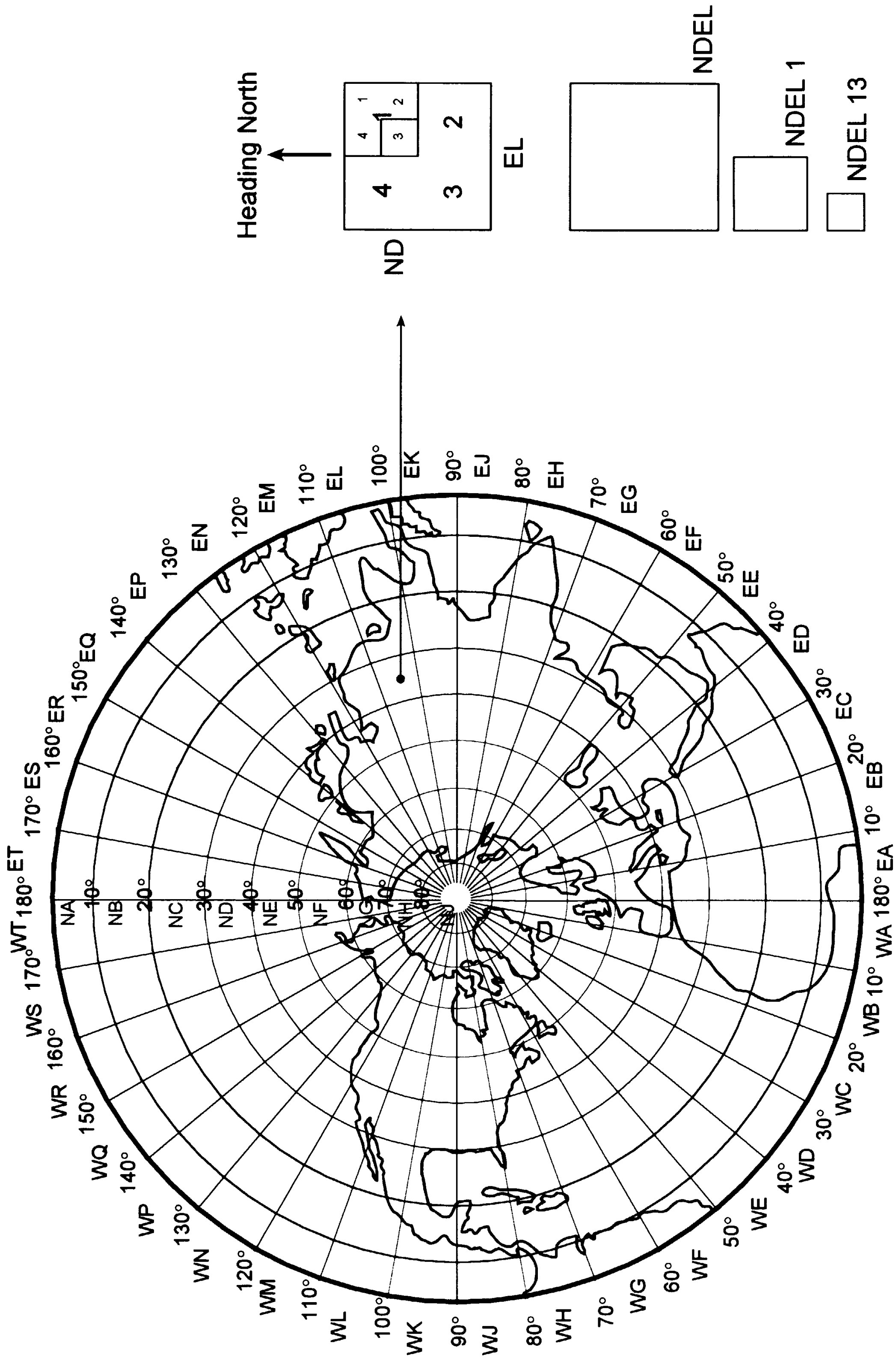


Figure F-I.

AREAS of VALIDITY for the SOUTHERN HEMISPHERE

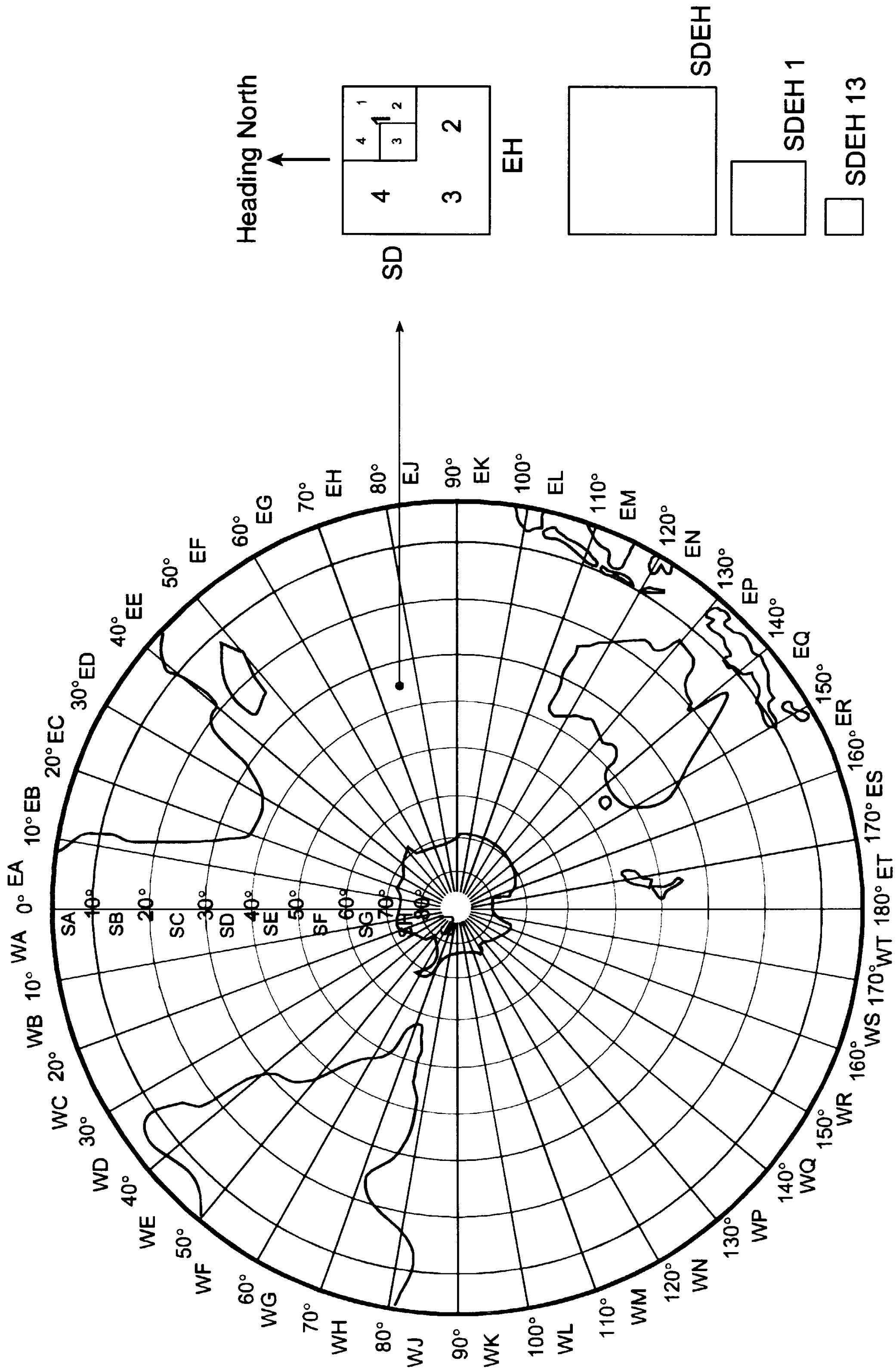


Figure F-II.

ANNEX G

GLOSSARY

ALL DEFINITIONS NOT APPEARING IN AAP 6 ARE INDICATED BY A BRACKET CONTAINING THE SHORT TITLE OF THE SOURCE FROM WHICH THEY ARE TAKEN.

absorbed dose

The amount of energy imparted by nuclear (or ionising) radiation to unit mass of absorbing material. The unit is the centigray (cGy). *See also radiation* dose.

aerosol

System of colloidal (finely divided) particles dispersed in gas (e.g. fog or smoke). (Concise Oxford Dictionary)

air burst

An explosion of a bomb or projectile above the surface as distinguished from an explosion on contact with the surface or after penetration. *See also type* of burst.

altitude

The vertical distance of a level, a point or an object considered as a point, measured from mean sea level. *See also elevation; high altitude; pressure* altitude.

area command

A command, which is composed of those organised elements of one or more of the armed services, designated to operate in a specific geographical area, which are placed under a single commander.

area of militarily significant fallout

The area in which radioactive fallout affects the ability of military units to carry out their normal mission.

army corps

A formation larger than a division but smaller than an army or army group. It usually consists of two or more divisions together with supporting arms and services. *Also called "corps".*

army group

The largest formation of land forces, normally comprising two or more armies or army corps under a designated commander.

atmosphere

Gaseous envelope surrounding the earth. (Concise Oxford Dictionary)

atomic demolition munition

A nuclear device designed or adapted for use as a demolition munition.

atomic weapon

See nuclear weapon.

automatic data handling

A generalisation of automatic data processing to include the aspect of data transfer.

azimuth angle

An angle measured clockwise in the horizontal plane between a reference direction and any other line.

base surge

A cloud, which rolls out from the bottom of the column, produced by a subsurface burst of a nuclear weapon. For underwater bursts the surge is, in effect, a cloud of liquid droplets, which has the property of flowing almost as if it were a homogeneous fluid. For subsurface land bursts the surge is made up of small solid particles but still behaves like a fluid.

biological agent

A micro-organism (or micro-organism product (toxin)) which causes disease in man, plants or animals or causes the deterioration of materiel. *See also* biological operation; biological weapon; chemical agent.

biological ammunition

A type of ammunition, the filler of which is primarily a biological agent.

biological defence

The methods, plans and procedures involved in establishing and executing defensive measures against attack utilising biological agents.

biological operation

Employment of biological agents to produce casualties in man or animals and damage to plants or materiel; or defence against such employment.

biological warfare

See biological operation.

biological weapon

An item of materiel, which projects, disperses, or disseminates a biological agent including arthropod vectors.

blister agent

A chemical agent which injures the eyes and lungs, and burns or blisters the skin. Also called "vesicant agent".

blood agent

A chemical compound, including the cyanide group, that affects bodily functions by preventing the normal transfer of oxygen from the blood to body tissues. Also called "cyanogen agent".

centigray

Unit of absorbed dose of radiation (ATP45). (Replaced the rad for combat dosimetry).

chemical agent

A chemical substance which is intended for use in military operations to kill, seriously injure, or incapacitate man through its physiological effects. Excluded from consideration are riot control agents, herbicides, smoke and flame. *See also chemical ammunition; chemical defence.*

chemical ammunition

A type of ammunition, the filler of which is primarily a chemical agent.

chemical, biological and radiological operation

A collective term used only when referring to a combined chemical, biological and radiological operation.

chemical casualty

A person who has been affected sufficiently, by a chemical agent to make him incapable of performing his duties or continuing his mission.

a. *immediate chemical casualty.* A person who becomes a casualty within one hour after being subjected to a chemical attack.

b. *delayed chemical casualty.* A person who becomes a casualty more than one hour after being subjected to a chemical attack (FM3-10).

chemical defence

The methods, plans and procedures involved in establishing and executing defensive measures against attacks utilising chemical agents.

chemical dosage

The product of the concentration of the agent in milligrams per cubic metre of air multiplied by the time of exposure in minutes ($mg.min/min^3$) (FM 3-10) *See also dosage.*

chemical dose

The amount of agent that is taken in or absorbed by the body (AAP-21). *(See also dose).*

chemical mine

A mine containing a chemical agent designed to kill, injure, or incapacitate personnel or to contaminate materiel or terrain.

chemical monitoring

The continued or periodic process of determining whether a chemical agent is present (ATP45). *See also chemical survey.*

chemical operation

Employment of chemical agents to kill, injure, or incapacitate, for a significant period of time, man or animals, and deny or hinder the use of areas, facilities or materiel, or defence against such employment.

chemical survey

The directed effort to determine the nature and degree of chemical hazard in an area and to delineate the perimeter of the hazard area. *See also* chemical monitoring.

chemical warfare

See chemical operation.

chemical warfare agent

See chemical agent.

civil defence

Mobilisation, organisation, and direction of the civil population, designed to minimise by passive measures the effects of enemy action against all aspects of civil life.

civil-military cooperation

Cooperation in peace or war between civil and military authorities, both NATO and national, with a view to ensuring an effective overall defence of the NATO area.

command, control and information system

An integrated system comprised of doctrine, procedures, organisational structure, personnel, equipment, facilities and communications which provides authorities at all levels with timely and adequate data to plan, direct and control their activities.

compass direction

The horizontal direction expressed as an angular distance measured clockwise from compass north.

compass north

The uncorrected direction indicated by the north seeking end of a compass needle. *See also magnetic north.*

contamination

The deposition and/or absorption of radioactive material, or of biological or chemical agents on and by structures, areas, personnel, or objects. *See also* induced radiation; residual radiation.

contamination control

Procedures to avoid, reduce, remove or render harmless, temporarily or permanently, nuclear, biological and chemical contamination for the purpose of maintaining or enhancing the efficient conduct of military operations.

conversion scale

A scale indicating the relationship between two different units of measurement. *See also scale.*

coordinates

Linear or angular quantities which designate the position that a point occupies in a given reference frame or system. Also used as a general term to designate the particular kind of reference frame or system such as plane rectangular co-ordinates or spherical coordinates. *See also geographic* coordinates; georef; grid coordinates.

cutaneous

Of the skin. (Concise Oxford Dictionary)

cyanogen agent

See blood agent. (AAP-21)

decay

The decrease in the radiation intensity of any radioactive material with respect to time. (AAP-21)

decay curve

Graph line representing the decrease of radioactivity with respect to time. (AAP-21)

decay rate

The rate of disintegration of radioactive material with the passage to time. (AAP-21)

decontamination

The process of making any person, object, or area safe by absorbing, destroying, neutralising, making harmless, or removing chemical or biological agents, or by removing radioactive material clinging to or around it.

a. *immediate decontamination.* The immediate decontamination process carried out by the individual upon becoming contaminated, to save life and minimise casualties. This may include decontamination of some personal clothing and/or equipment (NBCWP 27/89).

b. *operational decontamination.* The decontamination process carried out by individuals and/or units; restricted to specific parts of operationally essential equipment/materiel and/or working areas, in order to minimise contact and transfer hazards and to sustain operations. This may include further decontamination of the individual as well as decontamination of mission essential repair modules and limited terrain decontamination (NBCWP 27/89).

c. *thorough decontamination.* The decontamination process carried out by units, with or without external support, to reduce contamination on personnel, equipment/materiel, and/or working areas to the lowest possible level to permit the reduction or removal of individual protective equipment and maintain operations, with minimum degradation. This may include further terrain decontamination (NBCWP 27/89).

dosage

A measure of the amount of agent in a given volume of air to which troops are exposed for a period of time (FM 3-10). *See also chemical dosage;* radiation dose.

dose

Amount of radiation received by a person or thing exposed to it. *(See also chemical dose)* (Concise Oxford Dictionary)

dose rate contour line

A line on a map, diagram, or overlay joining all points at which the radiation dose rate at a given time is the same.

dosimetry

The measurement of radiation doses. It applies to both the devices used (dosimeters) and to the techniques.

downwind direction

The mean surface downwind direction in the hazard area during the forecast period towards which the cloud travels. (FM 3-10) *See also downwind speed*.

downwind speed

The mean surface downwind speed in the hazard area during the forecast period. *See also downwind direction.*

elevation

The vertical distance of a point or level, on, or affixed to, the surface of the earth, measured from mean sea level. *See also altitude.*

exposure dose

The exposure dose at a given point is a measurement of radiation in relation to its ability to produce ionisation. The unit of measurement of the exposure dose is the centigray (cGy).

fallout

The precipitation to earth of radioactive particulate matter from a nuclear cloud; also applied to the particulate matter itself.

fallout contours

Lines joining points which have the same radiation intensity that define a fallout pattern, represented in terms of cGy per hour.

fallout pattern

The distribution of fallout as portrayed by fallout contours.

fallout wind vector plot

A wind vector diagram based on the wind structure from the surface of the earth to the highest altitude of interest.

fireball

The luminous sphere of hot gases which forms a few millionths of a second after detonation of a nuclear weapon and immediately starts expanding and cooling.

fission

The process whereby the nucleus of a heavy element splits into (generally) two nuclei of lighter elements, with the release of substantial amounts of energy.

fission products

A general term for the complex mixture of substances produced as a result of nuclear fission

flash-to-bang time

The time from the beginning of radiation of light until the sound of the nuclear detonation is heard. The measured flash-to-bang time is used in connection with the estimation of the yield, which has been detonated.

fusion

The process whereby the nuclei of light elements combine to form the nucleus of a heavier element, with the release of tremendous amounts of energy.

geographic coordinates

The quantities of latitude and longitude which define the position of a point on the surface of the earth with respect to the reference spheroid. *See also* coordinates.

georef

A world wide position reference system that may be applied to any map or chart graduated in latitude and longitude regardless of projection. It is a method of expressing latitude and longitude in a form suitable for rapid reporting and plotting. (The term is derived form the words "The World Geographic Reference System").

gray

Unit of absorbed radiation dose, corresponding to one joule per kilogram. The unit for dose measurement will be the centigray (cGy) (STANAG 2957). *See also centigray.*

grid

See military grid.

grid coordinates

Coordinates of a grid coordinate system to which numbers and letters are assigned for use in designating a point on a gridded map, photograph, or chart.

grid north

The northerly or zero direction indicated by the grid datum of directional reference.

ground zero

The point on the surface of the earth at, or vertically below or above, the centre of a planned or actual nuclear detonation.

height of burst

The vertical distance from the earth's surface or target to the point of burst. *See also optimum height of burst; safe burst height.*

H-hour

The specific time at which an operation or exercise commences, or is due to commence. This term is used also as a reference for the designation of hours before or after the event.

high altitude

Conventionally, an altitude above 10,000 metres (33,000 feet). *See also altitude.*

high altitude burst

The explosion of a nuclear weapon which takes place at a height in excess of 100,000 feet (30,000 metres). *See also type of burst.*

hydrogen bomb
See thermonuclear weapon.

induced radiation
Radiation produced as a result of exposure to radioactive materials, particularly the capture of neutrons. *See also contamination; residual radiation.*

initial radiation
The radiation, essentially neutrons and gamma rays, resulting from a nuclear burst and emitted from the fireball within one minute after burst.

ionisation
The process of producing ions by the removal of electrons from, or the addition of electrons to, atoms or molecules.

isobar
Line on a map connecting places with the same atmospheric pressure at a given time or on average over a given period. (Concise Oxford Dictionary)

isodose rate line
See dose rate contour line.

kiloton weapon
A nuclear weapon, the yield of which is measured in terms of thousands of tons of trinitrotoluene explosive equivalents, producing yields from 1 to 999 kilotons. *See also megaton weapon; nominal weapon; sub kiloton weapon.*

low air burst
The fallout safe height of burst for a nuclear weapon which maximises damage to or casualties on surface targets. *See also type of burst.*

magnetic north
The direction indicated by the north seeking pole of a freely suspended magnetic needle, influenced only by the earth's magnetic field.

map reference
A means of identifying a point on the surface of the earth by relating it to information appearing on a map, generally the gratitude or grid.

maritime area
A maritime theatre of operations can be divided for the purposes of decentralisation of command into maritime areas and sub-areas, e.g., Atlantic theatre, which is divided into maritime area and sub-area commands.

maximum permissible dose
That radiation dose which a military commander or other appropriate authority may prescribe as the limiting cumulative radiation dose to be received over a specific period of time by members of his command, consistent with current operational military considerations.

mean lethal dose

a. The amount of nuclear irradiation of the whole body which would be fatal to 50 percent of the exposed personnel in a given period of time.

b. The dose of chemical agent that would kill 50 percent of exposed, unprotected and untreated personnel.

median incapacitating dose

The amount or quantity of chemical agent which when introduced into the body will incapacitate 50 percent of exposed, unprotected personnel.

megaton weapon

A nuclear weapon, the yield of which is measured in terms of millions of tons of trinitrotoluene explosive equivalents. *See also kiloton weapon; nominal* weapon; sub kiloton weapon.

meteorological data

Facts or information, pertaining to motions and phenomena of atmosphere, especially for weather forecasting. (Concise Oxford Dictionary)

military grid

Two sets of parallel lines intersecting at right angles and forming squares; the grid is superimposed on maps, charts, and other similar representations of the surface of the earth in an accurate and consistent manner to permit identification of ground locations with respect to other locations and the computation of direction and distance to other points. *See also military grid reference system.*

military grid reference system

A system which uses a standard-scaled grid square, based on a point of origin on a map projection of the surface of the earth in an accurate and consistent manner to permit either position referencing or the computation of direction and distance between grid positions. *See also military grid.*

monitoring

The act of detecting the presence of radiation and the measurement thereof with radiation measuring instruments.

national command

A command that is organised by, and functions under the authority of, a specific nation. It may or may not be placed under a NATO commander.

navigational grid

A series of straight lines, superimposed over a conformal projection and indicating grid north, used as an aid to navigation. The interval of the grid lines is generally a multiple of 60 or 100 nautical miles.

nerve agent

A potentially lethal chemical agent which interferes with the transmission of nerve impulses.

neutron induced activity

Radioactivity induced in the ground or an object as a result of direct irradiation by neutrons.

nominal weapon

A nuclear weapon producing a yield of approximately 20 kilotons. *See also kiloton weapon; megaton weapon; sub kiloton weapon.*

nuclear air burst

The explosion of a nuclear weapon in the air, at a height greater than the maximum radius of the fireball. *See also type of burst.*

nuclear cloud

An all-inclusive term for the volume of hot gases, smoke, dust and other particulate matter from the nuclear bomb itself and from its environment, which are carried aloft in conjunction with the rise of the fireball produced by the detonation of the nuclear weapon.

nuclear column

A hollow cylinder of water and spray thrown up from an underwater burst of a nuclear weapon, through which the hot, high pressure gases formed in the explosion, are vented to the atmosphere. A somewhat similar column of dirt is formed in an underground explosion.

nuclear defence

The methods, plans, and procedures involved in establishing and exercising defensive measures against the effects of an attack by nuclear weapons or radiological warfare agents. It encompasses both the training for, and the implementation of, these methods, plans and procedures. *See also* radiological defence.

nuclear detonation, detection and reporting system

A system deployed to provide surveillance coverage of critical friendly target areas, and indicate place, height of burst, yield, and ground zero of nuclear detonations.

nuclear radiation

Particulate and electromagnetic radiation emitted from atomic nuclei in various nuclear processes. The important nuclear radiations, from the weapon standpoint, are alpha and beta particles, gamma rays, and neutrons. All nuclear radiations are ionising radiations, but the reverse is not true; X-rays, for example, are included among ionising radiations, but they are not nuclear radiations since they do not originate from atomic nuclei.

nuclear strike warning

A warning of impending friendly or suspected enemy nuclear attack.

nuclear surface burst

An explosion of a nuclear weapon at the surface of land or water; or above the surface at a height less than the maximum radius of the fireball. *See* also type of burst.

nuclear underground burst

The explosion of a nuclear weapon in which the centre of the detonation lies at a point beneath the surface of the ground. *See also type of burst.*

nuclear underwater burst

The explosion of a nuclear weapon in which the centre of the detonation lies at a point beneath the surface of the water. *See also type of burst.*

nuclear warfare

Warfare involving the employment of nuclear weapons.

nuclear weapon

A complete assembly (i.e. implosion type, gun type or thermonuclear type) in its intended ultimate configuration which, upon completion of the prescribed arming, fusing and firing sequence, is capable of producing the intended nuclear reaction and release of energy.

nuclear yield

The energy released in the detonation of a nuclear weapon, measured in terms of the kilotons or megatons of trinitrotoluene required to produce the same energy release.

observation post

A position from which military observations are made, or fire directed and adjusted, and which possesses appropriate communications; may be airborne.

optimum height of burst

For nuclear weapons and for a particular target (or area), the height at which it is estimated a weapon of a specified energy yield will produce a certain desired effect over the maximum possible areas.

overlay

A printing or drawing on a transparent or semitransparent medium at the same scale as a map, chart, etc. to show details not appearing or requiring special emphasis on the original.

persistency

Pertains to duration of effectiveness; refers to the length of time a chemical or biological agent remains effective in the target area after dissemination by a particular agent munition combination. (FM 3-10)

precipitation

Rain, snow etc. falling to ground. (Concise Oxford Dictionary)

pressure altitude

An atmospheric pressure expressed in terms of altitude, which corresponds to that pressure in the standard atmosphere. *See also altitude.*

radiac

An acronym derived from the words "*ra*dioactivity, *d*etection, *i*ndication *a*nd *c*omputation" and used as an all-encompassing term to designate various types of radiological measuring instruments or equipment. (This word is normally used as an adjective).

radiac dosimeter

An instrument used to measure the ionising radiation absorbed by that instrument. (AAP-21)

radiation dose

The total amount of ionising radiation absorbed by material or tissues, expressed in centigray (cGy). *See also absorbed dose.*

radiation dose rate

The radiation dose (dosage) absorbed per unit of time.

radiation intensity

The radiation dose rate at a given time and place. *See radiation dose rate.*

radiation situation map

A map showing the actual and/or predicted radiation situation in the area of interest.

radiological defence

Defensive measures taken against the radiation hazards resulting from the employment of nuclear and radiological weapons.

radiological monitoring

See monitoring.

radiological operation

The employment of radioactive materials or radiation producing devices to cause casualties or restrict the use of terrain. It includes the intentional employment of fallout from nuclear weapons.

radiological survey

The directed effort to determine the distribution and dose rates of radiation in an area.

radius of safety

The horizontal distance from ground zero beyond which the weapon effects on friendly troops are acceptable.

reference point

A prominent, easily located point in the terrain.

residual contamination

Contamination which remains after steps have been taken to remove it. These steps may consist of nothing more than allowing the contamination to decay normally.

residual radiation

Nuclear radiation caused by fallout, radioactive material dispersed artificially, or irradiation which results from a nuclear explosion and persists longer than one minute after burst. *See also contamination; induced radiation; initial radiation.*

safe burst height

The height of burst at or above which the level of fallout, or damage to ground installations, is at a predetermined level acceptable to the military commander.

scale

The ratio or fraction between the distance on a map, chart, or photograph and the corresponding distance on the surface of the earth. *Also called "numerical scale"; "representative fraction". See also conversion scale.*

SOP

See standing operating procedure

spray dome

The mound of water spray thrown up into the air when the shock wave from an underwater detonation of a nuclear weapon reaches the surface.

standard NATO data message

NATO message formats and codes prescribed by a Standardisation Agreement and used to exchange information between participating national and/or international units or facilities.

standing operating procedure

A set of instructions covering those features of operations which lend themselves to a definite or standardised procedure without loss of effectiveness. The procedure is applicable unless ordered otherwise. *Also called "standard operating procedure".*

stratosphere

Layer of atmospheric air above troposphere, in most of which the temperature ceases to fall with increasing height, remaining constant. (Concise Oxford Dictionary)

sub kiloton weapon

A nuclear weapon producing a yield below one kiloton. *See also kiloton weapon; megaton weapon; nominal weapon.*

surface zero

See ground zero

surprise dosage attack

A chemical operation which establishes on target a dosage sufficient to produce the desired casualties before troops can mask or otherwise protect themselves.

task force

a. A temporary grouping of units, under one commander, formed for the purpose of carrying out a specific operation or mission.

b. Semi-permanent organisation of units, under one commander, formed for the purpose of carrying out a continuing specific attack.

c. A component of a fleet organised by the commander of a task fleet or higher authority for the accomplishment of a specific task or tasks.

thermonuclear

An adjective referring to the process (or processes) in which very high temperatures are used to bring about the fusion of light nuclei, with the accompanying liberation of energy.

thermonuclear weapon

A weapon in which very high temperatures are used to bring about the fusion of light nuclei such as those of hydrogen isotopes (e.g. deuterium and tritium) with the accompanying release of energy. The high temperatures required are obtained by means of fission.

TNT-equivalent

A measure of the energy released from the detonation of a nuclear weapon, or from the explosion of a given quantity of fissionable material, in terms of the amount of TNT (trinitrotoluene) which could release the same amount of energy when exploded.

total dosage attack

A chemical attack/fire mission used to build up the required dosage over an extended period of time. Normally employed against troops who have no protection available.

tropopause

The transition zone between the stratosphere and the troposphere. The tropopause normally occurs at an altitude of about 25.000 to 45.000 feet (8 to 15 kilometres) in polar and temperate zones and at 55.000 feet (20 kilometres) in the tropics.

troposphere

The lower layers of atmosphere, in which the change of temperature with height is relatively large. It is the region where the clouds form, convection is active, and mixing is continuous and more or less complete.

true north

The direction from an observer's position to the geographic North Pole. The north direction of any geographic meridian.

type of burst

See airburst; high altitude burst; nuclear airburst; nuclear surface burst; nuclear underground burst; nuclear underwater burst.

universal transverse Mercator grid.

A grid coordinate system based on the transverse Mercator projection applied to maps of the earth's surface extending to 84°N and 80°S latitudes.

vapour

Gaseous form of a normally liquid or solid substance. (Concise Oxford Dictionary)

vesicant agent

See blister agent.

weapon debris

The residue of a nuclear weapon after it has exploded; that is, materials used for the casing and other components of the weapon, plus unexpended plutonium or uranium, together with fission products. (AAP-21)

wind velocity

The horizontal direction and speed of air motion.

zulu time

Greenwich Mean Time.

ANNEX H

ABBREVIATIONS/ACRONYMS/LEGAL ENTRIES/SETS

This list contains abbreviations, legal entries, sets and acronyms used within this publication.

Abbr./Acronym	Legal Entry	Set	Explanation
	A		Air Sample
act.	AA		Actual Location
	ABD		Automated Biological Detector
AC	AC		Hydrogen Cyanide
	ACD		Automated Chemical Detector
ADM			Atomic Demolition Munitions
ADP			Automatic/Automated Data Processing
AEP			Allied Engineer Publication
AGCF			Air-Ground Correlation Factor
	AIR		Aircraft
		AKNLDG	Acknowledge Requirement - Sets introduced to accommodate ADatP-3 requirements
		ALFA	Strike Serial Number
		ALFAM	Effective Downwind for Yield Group ALFA - Letter “M” added to identify meteorological sets
		ALFAW	Strikwarn Target Identifier - Letter “W” added to identify warning sets
α	ALP		Alpha
AN			Alpha-Numerical
ANS			Alphabetic Numeric Special characters
	ARD		Automated Radiation Detector
		AREAM	Area of Validity - Letter “M” added to identify meteorological sets
ATP			Allied Tactical Publication
	B		Biological Attack

Abbr./Acronym	Legal Entry	Set	Explanation
	BAC		Bacterial
	BARE		Bare
β	BETA		Beta
	BIDS		Biological Identification and Detection System
BIO	BIO		Biological
	BIOCHEM		Biological or chemical Report
BL	BL		Blister Agent
	BLOD		Blood Agent
	BML		Bomblet
	BOM		Bomb
	BOT		Bottom
	BQM2		Becquerel per square metre
	BQM3		Becquerel per cubic metre
	BQS		Becquerel
		BRAVO	Location of Observer and Direction of Attack or Event
		BRAVOM	Effective Downwind for Yield Group Bravo - Letter "M" added to identify meteorological sets
	BSDS		Biological Stand-off Detection System
	BTL		Pressurised Bottle (ROTA)
	BUK		Bunker (ROTA)
	BWF		Basic Wind Forecast
	BWM		Basic Wind Data Message
BWR	BWR		Basic Wind Report
BZ	BZ		Quinuclidinyl benzilate
C			Conditional
	C		Chemical Attack
	C		Celcius/Centigrade

Abbr./Acronym	Legal Entry	Set	Explanation
	CAM		Chemical Agent Monitor
	CAN		Cannon
CB	CB		Cloud Bottom
CDF	CDF		Chemical Downwind Forecast
CDM	CDM		Chemical Downwind Message
CDR	CDR		Chemical Downwind Report
Cs-137	CES		Cesium-137
CF	CF		Correlation Factor
CG	CG		Phosgene
	CGH		Centigray per Hour
cGy	CGY		Centigray
		CHARLIE	Date-Time Group of Report or Observation and End of Event
		CHARLIEM	Effective Downwind for Yield Group Charlie - Letter “M” added to identify meteorological sets
CHEM	CHEM		Chemical
	CHOK		Choking agent
CK	CK		Cyanogen chloride
	CLA		Chlamydia
	CLOUD		Visisble Cloud
Co-60	COB		Cobalt-60
	CON		Storage Container (ROTA)
	CONT		Continous
CPDS			Chemical Prediction Data Sheet
	CRATER		Crater Present
	CSH		Centisievert per Hour
	CSV		Centisievert
CX	CX		Phosgene oxime

Abbr./Acronym	Legal Entry	Set	Explanation
DA			Total downwind distance of the center of the BIO cloud in km.
	DAY		Day
DE			Extended distance in km.
	DECR		Decreasing
Deg	DEG		Degrees
		DELTA	Date-Time Group of Attack or Detonation and Attack End
		DELTAM	Effective Downwind for Yield Group Delta - Letter “M” added to identify meteorological sets
		DELTAW	Date-Time of Strike or Strike Cancelled - Letter “W” added to identify warning sets
	DET		Other Automated Detector
	DF		Decay Faster than Normal
	DGG		Degrees/Grid North
	DGM		Degrees/Magnetic North
DGT	DGT		Degrees/True North
DHD	DHD		Downwind Hazard Distance
DL	DL		Leading edge distance in km.
	DN		Decay Normal
DP	DP		Di-Phosgene
	DRM		Nominal Storage Drum (55 Gallons/200 litres)
	DS		Decay slower than normal
DT			Trailing edge distance in km.
DTG		DTG	Date Time Group
		ECHOM	Effective Downwind for Yield Group Echo - Letter “M” added to identify meteorological sets
	EDF		Effective Downwind Forecast
EDM	EDM		Effective Downwind Message
EDR	EDR		Effective Downwind Report

Abbr./Acronym	Legal Entry	Set	Explanation
EDW	EDW		Effective Downwind
	EE		Estimated Location
ERG			Emergency Response Guide
EWS			Effective Downwind Speed
		EXER	Exercise Identification
	F		Fahrenheit
	FF		Fresh Reactor Fuel
	FIRE		Burning Fire
	FL		Nuclear Weapon Fallout
	FLAT		Flat Terrain
	FOX		NBC Reconnaissance Vehicle
		FOXONEW	Minimum Safe Distance One - Letter “W” added to identify warning sets
		FOXTWOW	Minimum Safe Distance Two - Letter “W” added to identify warning sets
		FOXTROT	Location of Attack or Event
		FOXTROTM	Effective Downwind for Yield Group Foxtrot - Letter “M” added to identify meteorological sets
ft/sec			Feet per Second
G	G		Nerve G agent
χ	GAM		Gamma
GA	GA		Tabun
GB	GB		Sarin
GD	GD		Soman
	GEN		Generator (Aerosol)
		GENTEXT	General Text
		GEODATUM	Geodetic Datum
GF	GF		Cyclo-Sarin

Abbr./Acronym	Legal Entry	Set	Explanation
GMT	GMT		Greenwich Mean Time
GN	GN		Grid North
		GOLF	Delivery and Quantity Information
		GOLFM	Effective Downwind for Yield Group Golf - Letter “M” added to identify meteorological sets
GZ	GZ		Ground Zero
H	H		Mustard agent
HD	HD		Mustard distilled
	HIGH		High Confidence
HL	HL		Mustard-Lewisite
HN	HN		Nitrogen mustard
HOB	HOB		Height of Burst
		HOTEL	Type of Nuclear Burst
		HOTELW	Number of Surface Bursts - Letter “W” added to identify warning sets
hPa			Hecto Pascal
HQ	HQ		Headquarters
	HR		Hour
HT	HT		Trimeric mustard
	IBDS		Integrated Biological Detector System
ICt	ICT		Incapacitating Dosage
ICt_{50}	ICT50		Median Incapacitating Dosage
	ID		Incapacitating Dose
ID			Inside Dose Rate
ID	ID		Identification
	INCP		Incapacitating agent
	INCR		Increasing
		INDIA	Release Information on Biological/Chemical Agent Attacks

Abbr./Acronym	Legal Entry	Set	Explanation
			or ROTA Events
		INDIAW	Number of Bursts in a Multiple Strike - Letter “W” added to identify warning sets
	INIT		Initial
	IO		Iodine
	IRT		Irritant
		JULIET	Flash-To-Bang Time in Seconds
		KILO	Crater Description
km/h	KPH		Kilometre per Hour
KT	KT		Kilo Ton
	KTS		Knots
	L		Liquid Sample
L	L		Lewisite
LAT/LONG			Latitude/Longitude
		LAYERM	Wind Conditions at 2,000m Increments up to 30,000m - Letter “M” added to identify meteorological sets
lb			Pounds
LCt	LCT		Lethal Dosage
	LD		Lethal Dose
LD_{50}	LD50		Median Lethal Dose
	LEAK		Continous Flow from Damaged Pipe or Container
		LIMA	Nuclear Burst Angular Cloud Width at H+5 Minutes
	LIQUID		Liquid
	LOW		Low Confidence
	LRG		Large Release (ROTA)
	LSCAD		Lightweight Stand-off Chemical Agent Detector
LSSN	LSSN		Local Strike Serial Number
M			Mandatory

Abbr./Acronym	Legal Entry	Set	Explanation
	MED		Medium Confidence
MERWARN	MERWARN		Warning of fallout endangering merchant shipping
MET	MET		Meteorological
MeV			Million electro Volts
MF			Multiplication Factor
		MIKE	Stabilised Cloud Measurement at H+10 Minutes
		MIKER	Description and Status of ROTA Event
			Mils
			Milligrams per square metre
			Milligrams per cubic metre
MGRS			Military Grid Reference System
			Minute
			Mils/Grid North
			Mils/Magnetic North
MLRS			Multiple Launched Rocket System
			Mils/True North
	MM3		Milligram-minutes per cubic metre
	MNE		Mine
	MMS		Mass Spectrometer
	MON		Month
	MOR		Mortar
mph	MPH		Miles per Hour
m/sec	MPS		Metres per Second
		MSGID	Message Identifier

Abbr./Acronym	Legal Entry	Set	Explanation
	MSH		Millisievert per Hour
	MSL		Missile
	MSV		Millisievert
MT	MT		Mega Ton
MTF			Message Text Format
N	N		Neutral
	N		No, not conducted
	N		Nuclear Attack
Num.	N		Numerical
NBC	NBC		Nuclear, Biological, Chemical
NBC ACC	NBC ACC		NBC Area Control Centre
NBC BWF	NBC BWF		NBC Basic Wind Forecast
NBC BWM	NBC BWM		NBC Basic Wind Message
NBC BWR	NBC BWR		NBC Basic Wind Report
NBC CC	NBC CC		NBC Collection Centre
NBC CDF	NBC CDF		NBC Chemical Downwind Forecast
NBC CDM	NBC CDM		NBC Chemical Downwind Message
NBC CDR	NBC CDR		NBC Chemical Downwind Report
NBC EDF	NBC EDF		NBC Effective Downwind Forecast
NBC EDM	NBC EDM		NBC Effective Downwind Message
NBC EDR	NBC EDR		NBC Effective Downwind Report
		NBCEVENT	Type of NBC Report
NBC RWC	NBC RWC		NBC Reporting & Warning Centre
NBC SCC	NBC SCC		NBC Sub Collection Centre
	NBCSITREP		NBC Situation Report
NBC WRC			NBC Warning and Reporting Centre
NBC ZCC	NBC ZCC		NBC Zone Control Centre

Abbr./Acronym	Legal Entry	Set	Explanation
	NEG		Negative Results
	NERV		Nerve agent
n	NEU		Neutron
NF			Normalising Factor
	NIL		No agent detected (only used in NBC 4)
NM	NM		Nautical Mile
	NONE		No Crater Present
		NOVEMBER	Estimated Nuclear Yield in Kilotons
NP	NP		Non-Persistent
NUC	NUC		Nuclear
O			Immediate (message)
O			Operationally Determined
Obs.	OBS		Observed
OCF			Overall Correlation Factor
OD			Outside Dose Rate
	OF		Spent Reactor Fuel
		OPER	Operation Codeword
		ORGIDDFT	Organisation Designator of Drafter/Releaser
		OSCAR	Reference Date-Time-Group for Estimated Contour Lines
OSSN			Official Strike Serial Number
	OTH		Other (use GENTEXT to specify)
	OTR		Other agent
P	P		Persistent
		PAPAA	Predicted Attack/Release and Hazard Area
		PAPAB	Detailed Fallout Hazard Prediction Parameters
		PAPAC	Radar Determined External Contour of Radioactive Cloud

Abbr./Acronym	Legal Entry	Set	Explanation
		PAPAD	Radar Determined Downwind Direction of Radioactive Cloud
		PAPAX	Hazard Area Location for Weather Period
	PEAK		Peak
	PENT		Penetrating agent
PF			Protection Factor
	PLT		Plant
	POOL		Large Quantity of Still Liquid
	POS		Positive results
	PPB		Parts per Billion (10^9)
	PPM		Parts per Million (10^6)
PS	PS		Chloropicrin
Pu	PU		Plutonium
	PUFF		Single Release of a Cloud
		QUEBEC	Location of Reading/Sample/Detection and Type of Sample/Detection
	RB		Biological ROTA
	RC		Chemical ROTA
	RCT		Reactor (ROTA)
		REF	Reference
	RIC		Rickettsiae
	RKT		Rocket
	RLD		Railroad Car (ROTA)
	RN		Nuclear ROTA
	RNP		ROTA nuclear power plant
		ROMEO	Level of Contamination, Dose Rate Trend & Decay Rate Trend
ROTA	ROTA		Releases other than attack

Abbr./Acronym	Legal Entry	Set	Explanation
	RU		Unidentified ROTA
S	S		Stable
SA	SA		Arsin
	SAME		Same
	SCRUB		Scrubby Vegetation
	SEA		Sea
	SEC		Second
	SHL		Shell
	SHP		Ship
	SIBCA		Sampling and Identification of Biological and Chemical Agent
		SIERRA	Date-Time Group of Reading or Initial Detection of Contamination
	SIRA		Sampling and Identification of Radiological Agent
SL			Standard Level
	SML		Small Release (ROTA)
	SNTRY		Automated Chemical and Biological Agent Detector
SOP			Standing Operating Procedures
	SPEC		Radiation Spectrometer
	SPILL		Small Quantity of Still Liquid
	SPR		Spray
	SPRAY		Spraying
SSN			Strike Serial Number
	STK		Stockpile (ROTA)
	SUBS		Sub surface (SUBS is only used in NUC reports)
	SURF		Surface (release on ground impact)
	STRIKWARN		NBC Nuclear Strike Warning Message
susp.	SUS		Suspected

Abbr./Acronym	Legal Entry	Set	Explanation
		TANGO	Terrain/Topography and Vegetation Description
TF			Transmission Factor
TG	TG		Tear Gas
TIB			Toxic Industrial Biological
TIC			Toxic Industrial Chemical
TIM	TIM		Toxic Industrial Material
TIR			Toxic Industrial Radiological
TN			True North
	TNK		Storage Tank (ROTA)
	TOP		Cloud Top
	TOR		Torpedo
TOX			Toxic molecules
	TOX		Toxin
	TPT		Transport (ROTA)
	TRK		Truck or Car (ROTA)
U	U		Unstable
		UNITM	Units of Measurement - Letter “M” added to identify meteorological sets
Unk	UNK		Unknown
	URBAN		Urban
UTM	UTM		Universal Transverse Mercator
V	V		V-agent
	VALLEY		Valley
	VIR		Viral
	VMT		Vomiting agent
VX	VX		VX
		WHISKEY	Sensor Information

Abbr./Acronym	Legal Entry	Set	Explanation
		WHISKEYM	Surface Weather for the First Two Hour Period - Letter “M” added to identify meteorological sets
	WK		Week
	WOODS		Wooded Terrain
	WST		Waste (ROTA)
X	X		Character (N+AN)
	XLG		Extra Large Release (ROTA)
		XRAYA	Actual Contour Information
		XRAYB	Predicted Contour Information
		XRAYM	Surface Weather for the Second Two Hour Period - Letter “M” added to identify meteorological sets
	Y		Yes, conducted
		YANKEE	Downwind Direction And Downwind Speed
		YANKEEM	Surface Weather for the Third Two Hour Period - Letter “M” a
Z			Flash (message)
		ZULU	Actual Weather Conditions
		ZULUM	Period of Validity - Letter “M” added to identify meteorological sets

ATP-45(C)