CHAPTER 5

Biological Protection

Actions Before An Attack:
- Up-to-date immunizations
- Good hygiene
- Area sanitation
- Physical conditioning

Biological Attack Indicators:
- Mysterious illness (large number of soldiers)
- Large number of insects or unusual insects
- Large number of dead wild and domestic animals
- Artillery shells with less powerful explosions
- Aerial bombs that pop rather than explode
- Mist or or fog sprayed by aircraft

Actions During Suspected Attack:
- Wear protective mask
- Keep clothing buttoned up
- Consider any known biological agent cloud as a chemical attack

Actions After An Attack:
- Send NBC 1 Report
- Identify casualties (from symptoms they exhibit)
- Isolate soldiers with symptoms

Biological Hazard's Prediction

Suspect A Biological Attack When
- There are indications of a chemical attack, but no immediate effects
- A presumed chemical attack has occurred, but the agent has not been identified

Three Types Of Biological Attacks Are:
- Type A Case a—Point-source attack (example aerosol generator, bomb) or an area attack (as in artillery or bomb let attack). This type of attack includes toxins.
- Type A Case b—A spray fine.
- Type B—Large, liquid drop/ground contaminating attack

Biological Calculations

Maximum Downwind Hazard (MDWHD) = 4 X windspeed (kmph) X cloud duration *of greatest effects (Zone I)

☆ ***The cloud duration is a measure of the length of time a biological agent is likely to remain effective end aerosolized in the environment.***

Example of MDWHD Computation:
Time of attack: 0130
BMNT: 0430
Wind direction: 150 grid
Windspeed: 13 kmph
Cloud duration = 5 hrs MDWHD = 4 X 15 X 5 = 300 km
(3 hrs from time of attack to BMNT + 2 = 5 hrs)

Cloud Duration of the Greatest Effects (Zone I)
Daytime (from BMNT to sunset) 8 hours
Nighttime (from sunset to BMNT) # of hours from time of attack to BMNT + 2 (max of 8 hours)
Cloud Arrival Time (CAT) =

$$\text{Time of Attack (TOA)} + \frac{\textit{Distance (km) From Attack Area}}{\textit{Windspeed (kmph)}}$$

Simplified Downwind Hazard Prediction for Biological Agents

Downwind hazard prediction for biological agents is very similar to the procedure for chemical agents. The resulting prediction provides a minimum estimate of the danger zones for biological agents in general. After employment, actual sampling will produce a better indication of areas affected.

Indications of a Biological Attack

The NBCC will issue an NBC 3 chemical report to alert units in the immediate downwind hazard area. The NBC 3 chemical report equates to approximately 50% of Zone I of the simplified biological downwind hazard prediction. This warning will be adequate for the first 1 to 5 hours (depending on wind speed) units in the remainder of Zone I and Zone II of the biological hazard will need to receive NBC 3 biological reports for adequate warning.

The hazard area prediction will be less reliable as the distance and time from the point of attack increases. (If the wind changes, follow the same procedures for recalculation as for chemical hazard prediction.

$$\text{Cloud Exposure Time} = \text{(CET)} = \frac{\textit{Distance (km) From Attack Area}}{3 \textit{ x Windspeed (kmph)}}$$

The NBC 3 chemical report equates to approximately 50 percent of Zone I of the simplified biological downwind hazard prediction. This warning will be adequate for the first 1 to 5 hours (depending on wind speed). Units in the remainder of Zone I and Zone II of the biological hazard will need to receive NBC 3 biological reports for adequate warning.

All attacks during daytime and all toxin attacks must be presumed to have a cloud

duration of the greatest effects of 8 hours. Only for night attack is it necessary to compute this duration.

The 8-hour maximum for cloud duration is based upon agent decay by environmental conditions, particle fall, and cloud dissipation. The actual effectiveness to minimum hazard levels may extend to as much as 32 hours. (Four times the cloud duration of greatest effects.)

Meaning of Zones for Biological Areas

Zone I-More than 20% to 30% casualties.
Zone II—20% to 30% casualties, gradually decreasing to 1% to 3% casualties.
Outside the predicted area—No more than 1 % to 3% casualties.

Table 5-1. Pasquill Stability Classes

Class	Definition
A	Extremely unstable
B	Moderately unstable
C	Slightly unstable
D	Neutral
E	Slightly Stable
F	Moderately Stable

Conditions					
Daytime			Nighttime		
Surface wind speed m/sec	Strong	Moderate	Slight	Cloudy	Clear
<2	a	A-B	B		
2-3	A-B	B	C	E	F
3-4	B	B-C	C	D	E
4-6	C	C-D	D	D	D
>6	C	D	D	D	D

Type A Case a (Point Source Attack)

1. Derive the location of the attack from NBC 1 chemical report and plot the location on a map or template.

2. Draw a 1-km radius circle around the point of attack.

3. Determine the maximum downwind hazard.

MDWHD = 4 x windspeed (kmph) x cloud duration of greatest effects * (Zone I)
✲ ***The cloud duration is a measure of the length of time a biological agent is likely to remain effective end aerosolized in the environment.***

4. Draw a line from the point of attack along the representative downwind direction, equal in length to the MDWHD.

5. Draw a line perpendicular to the representative wind direction, intersecting the point of the MDWHD.

6. Extend the line along the representative wind direction for a distance twice the radius of the circle around the attack area from GZ, in the direction behind the attack area.

7. From the rear endpoint of the representative wind direction line, draw two lines that intersect this point, are tangent to the attack area circle, and intersect the line of MDWHD.

8. Erase the area bebind the attack area circle. The remaining area constitutes the Zones I and II hazard area. The points shown on the diagram define the hazard area. Indicate these points on line PA of the NBC 3 Report.

9. Divide the MDWHD by 4. Plot this distance along the representative wind direction line. Draw a line perpendicular to the representative wind direction and which intersects both tangent lines at this point. The area within this smaller plot is the Zone I hazard area.

10. Report the two points at which the Zone I hazard line intersects the tangent lines on line ZB of the NBC 3 biological report.

Time of attack: 0330
BMNT: 0530
wind speed: 13 kmph
wind direction: 90 deg grid
MDWHD = 4x13x4=208 km
(2 hours from time of attack to BMNT + 2 hours = 4)

Type A Case a (area attack)

1. Derive the location of the attack from NBC 1 chemical report and plot it on the map.

2. Plot a circle with a radius of 1 km, unless the attack area radius is known to be more than 1 km. If the attack area is known to be greater than 1 km, plot a circle with a radius equal to the radius of the attack area around the center of the attack area. The circle must have a minimum radius of 1 km.

3. All subsequent procedures are exactly as outlined in the Type A, Case a point-source sample.

Time of attack: 2230
BMNT: 0700
wind speed: 15 kmph
wind direction: 60 deg grid
MDWHD=4x15x8=480km
(maximum 8 hours BMNT)

Type A, Case b (linear spray)

1. Derive the location of the attack area from NBC 1 chemical report. (A number of reports may need to be evaluated). Plot the attack area or spray line on the map.

a. Draw a line through the attack area from the start point to the end point.

2. Draw l-km-radius circles around the beginning point and endpoint of the spray line.

3. Determine the MDWHD, as in Case a.

4. From each endpoint of the spray line, draw a line equal in length to the MDWHD along the representative downwind direction.

5. Draw a perpendicular line intersecting the MDWHD point on the representative wind direction line drawn from the attack area endpoint furthest downwind. This is the line of maximum downwind hazard.

6. Extend each representative wind direction line 2 km behind each endpoint of the spray line.

7. Draw a line from each point 2 km behind the endpoints tangent to the outer side of each circle, until it intersects the MDWHD line.

8. Draw a line tangent to the rear of both attack circles. Erase the area behind the attack circles. This figure encompasses the Zone II hazard area. Report the points delineating this area.

9. Divide the MDWHD by 4. Plot this distance from the attack area endpoint furthest downwind on the representative wind direction line. Draw a line perpendicular to this point and which intersects both tangent lines. This smaller figure is the Zone I hazard area. Report the point of intersection with the tangent lines as Zone I on line ZB of the NBC 3 biological reports.

Time of attack: 0930
BMNT: 0700
wind speed: 2 kmph
wind direction: 90 deg grid
spray length: 10 km
MDWHD=4x12x8=384km

Type B (large, liquid drops, ground contaminating attack)

1. Derive the location of the attack area from NBC 1 biological report, and plot it on the map.

2. Draw a circle with a radius equal to the radius of the attack area. This circle should have a minimum radius of 5 km.

3. Report the hazard area as three digits on line PA of the NBC 3 biological report.

Table 5-2. Potential Biological Warfare Agents.

Microorganism	Mode of Transmission	Incubation Period (Days)[2]	Mortality Rate (Percent)2	Vaccine ([3])	Treatment ([4])
Bacteria					
Bacillus Anthracis (Anthrax)	A, D[9], I	1-7	5-1005	+	E[6]
Francisella Tularensis (Tularemia)	A, D[9], I, V	1-10	<30	+ +	E
Yersinia Pestis (Plague)	A, V	2-6	25-1007	+ + +	E[6]
Vibrio Cholerae (Cholera)	I	1-5	15-90	+ + +	E
Corynebacterium Diptheriae (Diptheria)	A, D[9]	2-5	5-12	+ + +	E
Salmonella Typhi (Typhoid Fever)	I	6-21	7-14	+ + +	E
Rickettsiae					
Rickettsia SPP (Spotted fevers group)	V	6-15	10-40	+ + +	E
Rickettsiae (Endemic or flea-borne typhus)	V	6-14	2-5	N	E
Rickettsia (Rocky Mountain spotted fever)	V	3-10	30 (approx)	N	E
Coxiella Burnetii (Q fever)	A, I	14-21	<1	+ +	E

[1] Transmission can be by aerosol-A, direct contact-D, ingestion-I, and/or vector-V.
[2] Incubation periods and mortality rates vary according to a number of factors (such as ability of the host to resist infection, infective dose, portal of entry, and virulence of the microorganism).
[3] + indicates vaccine available but of questionable value; + + indicates vaccine available, but mainly used in high risk individuals; + + + indicates vaccine used extensively; N indicates no vaccine available.
[4] E indicates effective treatment available; N indicates no specific treatment.
[5] The mortality rate is lower when the agent enters through the skin; higher when it enters through the respiratory tract.
[6] Treatment must be initiated in the earliest stage of the pulmonary form to be effective.
[7] The 25 percent represents mortality due to bubonic form; 100 percent represents mortality due to pneumonic form.
[8] Mosquitoes are thought to be the primary vectors, but this has not been proven.
[9] Direct contact refers to being bitten by a rabid animal, which is the usual means of transmission, or coming into contact with a rabid animal.

Table 5-2. Potential Biological Warfare Agents (continued).

Microorganism	Mode of Transmission	Incubation Period (Days)[2]	Mortality Rate (Percent)2	Vaccine ([3])	Treatment ([4])
Viruses					
Eastern Equine Encephalitis (EEE)	V[8]	4-24	60 (Approx)	N	N
Venezuelan Equine Encephalitis (VEE)	V[8]	4-24	<1	+ +	N
Japanese B Encephalitis	V (Mosquito)	5-15	10-80	+ +	N
Russian SpringùSummer Encephalitis (RSSE)	V (Tick)	7-14	3-40	+	N
Yellow Fever	V (Mosquito)	3-6	5-40	+ + +	N
Dengue Fever	V (Mosquito)	4-10	<1	+	N
Pox Virus					
Variloa Virus (Smallpox)	A, D[9]	7-16	10-25	+ + +	N
Hantaan Virus (Hemorrhagic Fever with Renal Syndrome)	A, V				
Phlebovirus (Rift Valley Fever)	V (Mosquito)	4-6	<1	N	N
Nairovirus (Crimean-Congo Hemorrnagil Fever)	V (Tick)	3-7			
Bunyavirus (LA Crosse)	V (Mosquito)				
Phlebovirus(Sandfly)	V (Sand fly)	3-6			

[1] Transmission can be by aerosol-A, direct contact-D, ingestion-I, and/or vector-V.
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[3] + indicates vaccine available but of questionable value; + + indicates vaccine available, but mainly used in high risk individuals; + + + indicates vaccine used extensively; N indicates no vaccine available.
[4] E indicates effective treatment available; N indicates no specific treatment.
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[7] The 25 percent represents mortality due to bubonic form; 100 percent represents mortality due to pneumonic form.
[8] Mosquitoes are thought to be the primary vectors, but this has not been proven.
[9] Direct contact refers to being bitten by a rabid animal, which is the usual means of transmission, or coming into contact with a rabid animal.

Table 5-3. Threat Toxins.

Type of Toxin	Means of ID	Symptoms in Man	Effects on Man	Rate of Action	How Normally Disseminated	Protection Required	Decontamination
Mycotoxins	None	Vomiting, eye and skin irritation, dizziness, bloody diarrhea, and blisters.	Can incapacitate or kill, depending on concentration.	Rapid	Dusts, droplets, aerosols, smokes, or covert means	Protective mask and protective clothing	Soap and water, bleach, M258-series kit, STB and DS2
Enterotoxins	None	Severe vomiting and diarrhea, painful cramps, and weakness	Primarily incapacitates, assuming proper first aid is conducted	Same as above	Same as above	Same as above	Same as above
Botulinum Toxin	None	Double vision, weakness, difficulty in speech and swallowing, and respiratory paralysis	Kills	Delayed	Same as above	Same as above	Same as above