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Field Behavior of NBC Agents

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Preface

Primary users of this manual are NBC staff officers, staff weather officers, fire support coordination personnel, artillery officers, and others involved in planning NBC operations. These soldiers must understand what effect weather and terrain have on nuclear, biological, and chemical (NBC) operations and smoke. This manual contains general information and the basic principles on how to get the best results. Commanders and staffs involved in planning for use of incendiaries or smoke operations will also benefit from the use of this manual along with other references such as FM 3-50, FM 3-100, FM 3-3, FM 3-4, and FM 3-5.

On the battlefield, the influences of weather and terrain on NBC operations provide opportunities to both sides. To retain the initiative, friendly forces leaders and staff officers must understand how weather and terrain can be used to their advantage.

FM 3-6 implements International Standardization Agreement (STANAG) 2103, Reporting Nuclear Detonations, Radioactive Fallout, and Biological and Chemical Attacks and Predicting Associated Hazards.

This manual explains how weather and terrain influence nuclear, biological, and chemical operations and discusses the following topics for use when planning operations:

- Basic principles of meteorology as they pertain to NBC operations.
- Influence of weather on the use and behavior of NBC agents.
- Local weather predictions and their use.
- Influence of terrain on the behavior of NBC agents.
- US Air Force Air Weather Service (AWS) forecasts and their use in planning for operations in an NBC environment. (The Navy gets meteorological forecasts from components of the Naval Oceanography Command. Meteorological report information is in the NAVOCEANCOMINST 3140.1 publications series. It also contains information on the behavior of smoke clouds and incendiaries. In addition, it discusses the influences of weather and terrain on the thermal, blast, and radiation effects of a nuclear detonation.)

Staffs planning the use of chemical weapons and commanders approving strikes must understand basic weather characteristics. Therefore, weather analyses significantly influence the selection of agents and munitions for employment. The target analyst must know his or her weather data needs and where to get this information in a combat environment. Chapter 1 covers meteorology and the impact of weather on chemical agent use. The remaining chapters address the impact of weather on smoke, incendiaries, biological agents, and nuclear detonations.

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FIELD BEHAVIOR OF NBC AGENTS (INCLUDING SMOKE AND INCENDIARIES)

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CHAPTER 1

Chemical Agents

The field behavior of chemical agents is dependent on weather variables such as wind, temperature, air stability, humidity, and precipitation. The influence of each variable depends upon the synoptic situation and is locally influenced by topography, vegetation, and soil.

Chemical agents may appear in the field in different forms: vapors, aerosols, or liquids. To understand the impact of chemical agents on the battlefield, the soldier must also understand how these agents are affected by weather and terrain. The following paragraphs give an overview of the basic characteristics of chemical agents and how weather and terrain influence and have specific effects on them.

Basic Characteristics

Vapors and small particles are carried by the winds, while any large particles and liquid drops fall out in a ballistic-like trajectory and are quickly deposited on the ground. Many agents give off vapors that form vapor clouds. The speed at which an agent gives off vapors is called volatility. Agents may be removed naturally from the air by falling out (large particles fall out much more quickly), by sticking to the ground or vegetation, or by being removed by precipitation. Once deposited upon vegetation or other ground cover, volatile agents may be re-released to the atmosphere for further cycles of travel and present a hazard until sufficiently diluted or decontaminated.

During approximately the first 30 seconds, the size and travel of an agent are determined primarily by the functioning characteristic of the munition or delivery system. Thereafter, the travel and diffusion of the agent cloud are determined primarily by weather and terrain. For example, in high temperatures, volatile agents produce maximum agent vapor in 15 seconds. Light winds and low turbulence allow high local concentrations of agents. High winds and strong turbulence reduce the concentration and increase the area coverage by more quickly carrying away and diffusing the agent cloud.

Vapors

When a chemical agent is disseminated as a vapor from a bursting munition, initially the cloud expands, grows cooler and heavier, and tends to retain its form. The height to which the cloud rises, due to its buoyancy, is called the height of the thermally stabilized cloud. If the vapor density of the released agent is less than the vapor density of air, the cloud rises quite rapidly, mixes with the surrounding air, and dilutes rapidly. If the agent forms a dense gas (the vapor density of the released agent is greater than the vapor density of air), the cloud flattens, sinks, and flows over the earth's surface. Generally, cloud growth during the first 30 seconds is more dependent upon the munition or delivery system than upon surrounding meteorological conditions.

Nevertheless, the height to which the cloud eventually rises depends upon air temperature and turbulence. These determine how much cooler, ambient air is pulled into the hot cloud (and, hence, determines its rate of cooling). The agent concentration buildup is influenced by both the amount and speed of agent release and by existing meteorological conditions.

Shortly after release, the agent cloud assumes the temperature of the surrounding air and moves in the direction and at the speed of the surrounding air. The chemical cloud is subjected to turbulence forces of the air, which tend to stretch it, tear it apart, and dilute it. The heavier the agent, the longer the cloud retains its integrity. Under conditions of low turbulence, the chemical agent cloud travels great distances with little decrease in agent vapor concentration. As turbulence