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On the Problem of Appraising the Radiation Situation

by

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The appraisal of the radiation situation has now become customary in the work of commanders and staffs and is one of the most important factors essential to decision making. But for this, it is necessary to receive the following initial information: time, coordinates and type of burst, the level of TNT equivalent of the weapon and the direction and velocity of the average high-altitude wind.

In the initial period of a war, not having sufficient experience, troops will encounter serious difficulties in receiving and quickly formulating the above-mentioned data. This complex task, until the development and adoption of specialized instruments, will be accomplished with available means rather approximately, and by many subunits, visually. In this process, substantial errors on the part of reconnaissance personnel and observers are possible. In order to preclude mistakes and to guarantee timely receipt of accurate initial information, it is necessary to devise a methodology for their determination. It is advisable to prepare, also, a group of tasks with the aim of training personnel in determining the coordinates of and, especially, the type and yield of nuclear bursts. In all exercises, also, such tasks should be assigned to appropriate subunits, and a timely report from them to the commanders and staffs should be required.

In the initial period of a war, it is extremely difficult for reconnaissance personnel and observers to ascertain the yield of a nuclear burst. It seems to us that the simplest method is to determine the yield of the burst with radar sets and optical instruments by the size, speed and altitude of ascent of the radioactive cloud, or even by its upper edge, since for each yield nuclear weapon there is a corresponding specific altitude of ascent of the radioactive cloud. Thus, for example, for nuclear weapon yields of 2, 5, 20, 50, 100, 200, or 500 kt. and 1 mgt., the altitude of ascent of the upper edge of the radioactive cloud is 5, 7, 10, 12, 14, 16, 19 and 21 km., respectively.

These or more complete data can be plotted in the free fields of radar sets, and on optical instruments, in order that they may always be before the eyes of the observers. This simple improvement will considerably facilitate the training of observers in estimating the yield of nuclear bursts. The experience of visual determination of the initial data indicates that it is indispensable, and with the adoption of specialized instruments, it will be effectively used by subunits for taking timely protective measures against a nuclear weapon until the receipt of more precise data.

The evolution of a radioactive cloud in a given area and the subsequent fallout of radioactive particles on the terrain from nuclear weapons of different yields will depend on the altitude of varying directions and velocities of wind. Therefore, having at a given time the velocities and directions of high-altitude winds, it is necessary with the burst of a nuclear weapon of a particular yield to determine the corresponding altitude of ascent of the radioactive cloud, the average high-altitude wind, and the direction of the diffusion of radioactive particles on the terrain. It is advisable to use this principle in the determination of the direction of diffusion of radioactive particles from our own surface nuclear bursts of different yields, in order to ensure the safety of the activities of our troops. It somewhat complicates the plotting on a map and the appraisal of the radiation situation, but at the same time it permits a more accurate estimate than when we take only a single direction and velocity of the average wind for all yields of nuclear weapons.

Plotting the radiation situation on a map is a laborious and prolonged process. In order to simplify it and speed it up in the staffs, a large quantity of different templates have been produced. The Textbook* supports preparing 46 templates for plotting the zone of radioactive contamination on small-scale maps, and an additional 50-60 templates for work on larger-scale maps. Moreover, it should be considered that templates alone are not enough; Tables** also are needed. All this greatly hampers the plotting of the radiation situation, especially under field conditions, while accuracy in its plotting remains doubly relevant.

The path of a radioactive cloud only in general resembles the shape of an ellipse, deviating greatly from its proper form. The configuration of the zone of contamination actually depends on many factors. Therefore, the isolines connecting equal levels of radiation will be irregular, differing markedly from those lines which are drawn according to the templates, thereby consuming a great deal of time.

In our view, it is necessary to plot the zones of radioactive contamination at four points, taken from the aforementioned official Tables, joining these points with wavy lines, taking into account ground relief, terrain features, and the directions of the surface layer wind. This method will considerably simplify and expedite the plotting of the radiation situation. Moreover, the shape of the zones of radioactive contamination on the maps will conform more closely to their true configurations on the terrain.

For practical work, in our opinion, it is fully sufficient

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* Methodology of Appraising the Radiation Situation in the Case of the Massed Employment of Nuclear Weapons and Some Problems in Protecting Troops Operating in Contaminated Terrain. Moscow. Voyenizdat, 1960.

** Tables for the Appraisal of Radioactive Contamination of Terrain with Atomic Bursts. Moscow. Voyenizdat, 1960.

to lay out on one sheet three tables on which to show information pertinent to the principal yields of nuclear weapons, taking into consideration three wind velocities: 30, 50 and 70 km. per hour. On the other side of the sheet it is advisable to put tables No. 1 and 3 from the referenced Text on methodology of appraising the radiation situation. This permits one to have all the material necessary for plotting and appraising the radiation situation on one sheet and eliminates the use of the cumbersome book of Tables.

In the method suggested by us in the table, it is sufficient to show the nearest and farthest boundaries of contamination by radioactive particles for corresponding levels of radiation on the large axis of an ellipse. The width of the zone of contamination will be determined without difficulty by the two other points as 1/6 of the length of the ellipse. The characteristics of the furthest drop in the level of radiation, shown in the Tables, may be located on a map with a dosage ruler (DL-1). The four points for each level of radiation of interest to us which have thus been plotted on a map must be joined by hand by straight or wavy lines, depending on the ground relief and the direction of the local winds. From this process there results an approximate representation of the sector of contamination. The levels of radiation in the zone of contamination should be more precisely defined by aerial and ground radiation reconnaissance.