c. Items (1), (2), (3), and (4) below will be confined to feasibility studies on paper and will not include laboratory or development work.

(1) Air-borne munitions to deny populated or otherwise critical areas for short periods of time.

(2) Air-borne munitions for attack against concentrations of troops.

(3) Surface munitions for attack against concentrations of troops.

(4) Subversive weapons for attack against populated or otherwise critical areas.

4. Discussion of Characteristics and Applications

a. Munitions for Long-Time Denial

The object of this development is to obtain munitions which will enable one airplane, one missile, a small ground force, or a subversive group to render a given critical area useless for a minimum period of one year. It is envisioned that such munitions would be useful against militarily-critical portions of populated areas, important military and naval installations, transportation facilities, factories, refineries, etc.

Eventually the study of radioactive elements of all types should be conducted. Initial work, however, will be based on the use of high-energy gamma emitters as the active agents because of:

(1) Probable availability of suitable elements by neutron-irradiation and as by-products in pile operation.

(2) Lethality through exposure of the body, requiring no special portal of entry or physical contact.

(3) No known feasible protective measures.

Although the above gamma-emitting agents have the great advantage of not requiring a particular portal of entry or physical contact for effectiveness, they have the great disadvantage of requiring shielding out of proportion to the weight of munition concerned. This disadvantage would probably preclude use of such munitions by small ground forces or subversive groups, and for these, beta and alpha emitters may be indicated. However, it is emphasized that the use of beta and alpha emitters by small ground forces or subversive groups is a subject of secondary interest, and work should be confined to feasibility studies

and simple experiments. Area contaminating weapons for gamma emitters are of primary importance, including use during planned evacuations.

b. Combined High Explosive and Radioactive Munitions

Addition of gamma emitters to high explosive munitions will serve to delay or prevent repair of physical damage because of radioactive contamination. Only a small amount of radioactive material in comparison with high explosive will be required. Such factors as the amount of shielding required, difficulties in handling, whether it is of value merely to force repair crews to mask (if alpha and beta emitters are used) will require prior consideration in the development of this type munition.

c. Munitions for Attack on Individuals

This class of munitions is proposed for use by secret agents or subversive units for lethal attack against small groups of important individuals, e.g., during meetings of civilian or military leaders. The source of the munition, the fact that an attack has been made, and the kind of attack should not be determinable, if possible. The munition should be inconspicuous and readily transportable. There should be no means of therapy.

Radioactive agents, because of their high toxicity and lack of effect on the senses, appear to be ideal for this purpose. It should be possible, for example, to develop a very small munition which could function unnoticeably and which would set up an invisible yet highly lethal concentration in a room, with the effects noticeable only well after the time of attack. The time for lethal effects could, it is believed, be controlled within limits by the amount of radioactive agent dispersed. The toxicities are such that should relatively high concentrations be required for early lethal effects, on a weight basis, even such concentrations may be found practicable. This subject is of secondary interest, and work should be confined to feasibility studies and simple experiments.

d. Munitions for Short-Time Denial

It is envisioned that such munitions would be used against targets similar to those considered for long-time denial, but which it may be desired to occupy undamaged at some relatively early date. Applications should be considered for:

(1) Contamination of large areas to a level of concentration such that evacuation would be required, and

(2) contamination of smaller, more critical areas to high levels such that even passage across the area would be denied.