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BIOLOGICAL EFFECTS OF LOW DOSES OF RADIATION

In response to a request from Commissioner Larson on the radiation levels at which damage to organisms appears, a few isolated examples have been collected.

Dr. L. B. Russell reported, Proc. Exp. Biol. Med., 95, 174 (1957) that an X-ray dose of 25 r to 7.5 day mouse embryos led to a marked increase in abnormalities of the skeleton. Similar observations, using a radiation dose of 18 r, were made by H. Kriegel, Abstracts of the Second International Congress of Radiation Research, 159 (1962). G. G. Polikarpor, Radioecology of Aquatic Organisms (English Edition) 1966, summarizes a number of studies of damage to various marine organisms (fish, frogs, newts) in embryonic or larval stages from radiation doses ranging upward from 2 r.

Studies by Dr. Alice Stewart, et.al, Br. Med. J., 1:1495 (1958) and by Dr. B. MacMahon, J. Nat. Cancer Inst., 28: 1173 (1962) have been considered generally to indicate higher than normal incidence of leukemia and of malignancies of the nervous system among persons who have received radiation doses of a few r (perhaps from about 1 to 5 r) during early fetal development. This interpretation of these studies has sometimes been questioned. The U.N. Scientific Committee on the Effects of Atomic Radiation observes in its 1969 Report (page 76, paragraph 62), "As with all medical surveys, the possibility cannot be excluded that the increased radiation risks may be, at least in part, spurious, since there is no way to separate the effect of radiation as such from that of the maternal condition that may have prompted the exposure."

"In an individual adult it is difficult or in some cases impossible to detect effects from a single external exposure of less than 25 to 50 r, and from continuing exposure to levels even about two orders of magnitude greater than natural background. It should be noted, however, that changes in the nucleus of lymphocytes have been described in some adult radiation workers after two weeks of exposure to levels as low as 0.20 r per week." (FRC Report No. 1, 5/18/60)*.

"In fetal organ systems, effects (e.g., delayed effects on blood forming tissues) may be evident with 2-10 r acute exposure, and skeletal effects with 24 r." (FRC Report No. 1, 5/18/60).

*It is not known whether these changes have any effect on health

"Studies of human cells grown in tissue culture have shown that doses as low as 25 r will cause detectable chromosome breakage in a significant proportion of the cells." (National Academy of Sciences (NAS), Summary Report, Biological Effects of Radiation, 1960).

"Studies of mutations /in Drosophila/... have indicated that acute doses as low as 5 r have a significant mutagenic effect and that the dose-effect curve is linear from lower to higher doses." (Report of the U.N. Scientific Committee on the Effects of Atomic Radiation, page 92, 1962).

There has not been an opportunity for a comprehensive study of the literature in this field.

Clifford K. Beck
Deputy Director of Regulation

cc: Secretary (2)
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