EFFECTS OF CONTACT FARM ANIMALS WITH RADIOACTIVE MATERIALS

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The damage assessment in livestock as a result of nuclear weapons relates not only to the immediate effects such as casualties produced, extent of blast damage, and fallout hazards, but also to the evaluation of such things as food and medical supplies, and to other resources important to the rehabilitation and reconstruction of the country and its economy. [1]

The irradiation of living systems can be external (space, natural sources, etc.) and internal (incorporated sources). Irradiation can be short and long. The irradiation can be continuous and fractionated (intermittent). The irradiation can be total (total body) and local (certain limited parts of the body). Irradiation can be radiation of one species and simultaneously with all kinds of radiation (alpha, beta particles, gamma rays). Very often the irradiation is combined, combined.[2]

Radio sensitivity is the ability of living organisms to react in response to irritation caused by the absorbed energy of ionizing radiation.

Radiation sensitivity of animals is estimated by the dose of radiation semi-legal (dying 50%), critical (dying 75%) and lethal (all 100% of the irradiated are killed organisms). Radioactivity is most often estimated at a lethal dose radiation Cell sensitivity to irradiation depends on the efficacy of the processes the exchange occurring in them, the number and density of the intracellular structures and cell division intensity. [2]

The external radiation burns due to contact with fission products or other radioactive nuclides following nuclear detonations are principally the result of beta radiation. They are injuries commonly seen on nearby animals following a nuclear detonation when particulate fallout material lodges in their coats or on their skins, thus keeping the radioactive elements in position sufficiently long to produce what has been called "beta burns". There can be a hazard to herdsmen and abattoir employees who handle the animals so exposed. Buildings and equipment can also become contaminated.[1]

It is quite possible that lethal physiological effects from beta radiation may rarely or never be seen in farm animals following nuclear detonations, since levels of beta radiation high enough to cause such effects would under most circumstances be accompanied by gamma radiation of sufficient magnitude to deliver an overwhelming total-body exposure. The

cattle accidentally exposed to about 39,000 rep at the Trinity Test in l945 survived. The ratio of skin exposure to total-body exposure was 39,000 rep (to multiple foci on the back) to l40 r of total-body exposure. Since the physiological response to the effects of beta particles on the skin is expressed by a mechanism different from that used for gamma exposure to the total body, the symptomatic response to a beta/gamma flux could be at most equal to the responses to the two types of radiation injury applied separately. From what is known by the observation of accidentally exposed animals, however, it probably is wise to consider the effects as overlapping and not additive to any marked extent.[1]

One difference between thermal burns and beta burns relates to time. The response to thermal burns is immediate, while several days or weeks may pass before physical signs of the beta burns are apparent. Doses required to effect a burn vary with the energy (Table DC) .

Table 1

Table EC Beta Radiation Producing Recognizable Injury to the Skin of a Pig

Isotope	**Average Energy (Mev)**	**Surface Dose (rads)**	**Estimated Beta Dose at 0.09 mm (rads, uc/cm2)**
Sulfur-35	0.l7	20,000	l,200
Cobalt-60	0.3l	4,000	l,600
Cesium- l37	0.55	2,000	l,700
Yttrium-9l	l.53	l,500	l,200
Phosphorous -32	l.7l	2,000	-
Strontium-90	2.70	2,000	-

These lesions may be classified by their severity:

l) Epidermal atrophy which follows a low dose of radiation. Although a slight depigmentation of the coat may be seen a few weeks after exposure, the skin is usually intact and any atrophy recognized is only microscopic.

2) Exfoliative dyskeratosis which follows a more intensive expose in which the skin becomes flaky and exfoliates/ (A chronic radiation dermatitis usually follows this type of burn.) Atypical cell forms are characteristically found in the epidermis, hair follicles tare usually destroyed, and the surrounding tissues produce a depigmented coat color .

3) Transepidermal necrosis, the severest type of beta burn which, except for the latent develop ment mentioned above , resembles a thermal burn with edema, bullous desquamation, and lesion, but the coat will not

regrow. Around the edges of such a wound may be found the lesions characteristic of the two lesser types of beta burns .

A carcinoma of the skin of the back eventually developed in three beef cows kept for l5-l7 years after the Trinity exposure to approximately 39,000 rep skin dose, delivered over l0% or more of the body surface, and l40 r total-body dose. External radiation burns upon the backs and feet of animals will detract little from their food value. It is unlikely that exposures of the back or feet of animals will contribute any substantial increase in the effects of external whole-body irradiation associated with it.

The injury from contact with fallout particles to the skin of food animals, usually the back, depends upon the contamination density and the length of time of the contact. This can be described by the term "accumulated contamination density" and expressed by the unit uc - hr/cm2. The term includes both the preceding factors and hence can be employed as a measure of hazard of skin irradiation due to fallout. The expression uc - hr/cm2 implies that it makes no difference whether an exposure of 200 uc - hr/cm2 results from 200 uc/cm^2 in contact with the skin for one hour or 20 uc/cm2 for ten hours. A very rough empirical relationship is as follows:

The beta-ray dose delivered by fission products on the skin (probably most applicable to swine) will be 5 rads/hr when the surface contamination on the ground equals that on the back of an animal and is one uc/cm^2/

Literature

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