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Radiomonitoring at “Nurobod Meat and Dairy” Llc in Nurobod District of Samarkand Region

Khakimov B.N.[1], Mirzaev B.Sh.[2], Ayupova J.R.[3]
1,2,3. Veterinary Research Institute

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Annotation: This article presents the results of radiometric monitoring conducted at “Nurobod Meat and Dairy” LLC located in the Nurobod district of the Samarkand region. During the study, samples of soil, alfalfa, water bodies, and hay collected from the farm territory were analyzed under laboratory conditions to determine their radiation levels. Based on the obtained results, the radiation background of the area was assessed, and scientific conclusions were drawn to ensure the safety of livestock products.

Keywords: Ionizing radiation, radioactive elements, radiation background, gamma radiation, radioactive fallout, dosimetry, veterinary facilities, environmental monitoring, feed safety.

Introduction

All living organisms on Earth are constantly exposed to ionizing radiation. According to their origin, sources of ionizing radiation can be classified into three main groups.

The first group includes radiation of cosmic origin. The second group consists of natural terrestrial sources, including radiation emitted from rocks, soil, water, air, as well as naturally occurring radioactive elements present in plants, animals, and even within the human body itself. These two groups together form the natural background radiation [1].

The third group includes radiation from artificial radionuclides formed as a result of nuclear weapon tests or accidents at nuclear power plants (such as Chernobyl and Fukushima), which are deposited on the Earth’s surface in the form of local, tropospheric, or global fallout [2].

All these sources, under certain conditions, can significantly affect the bodies of animals and humans through both internal and external exposure. The total radiation exposure from internal and external sources determines the overall radiation background [3].

In addition to naturally occurring radioactive isotopes present in the natural composition of elements, numerous artificial isotopes are produced through various nuclear reactions. These include neutron irradiation of stable elements in nuclear reactors or bombardment with heavy particles such as protons and alpha particles (e.g., Co-60). After nuclear tests or accidents, fission products such as iodine-131 (I-131), barium-140 (Ba-140), strontium-90 (Sr-90), and cesium-137 (Cs-137) are commonly detected [4].

Radioactive fallout resulting from nuclear tests or accidents can be classified as follows:

- **Local fallout** – deposited within approximately 100 km from the explosion site;
- **Tropospheric fallout** – spreads over hundreds to thousands of kilometers, with an average atmospheric residence time of about 30 days;
- **Stratospheric fallout** – contains the majority of radioactive decay products and contributes significantly to global environmental contamination [5].

Radioactive products of nuclear fission enter the biosphere either through dry deposition or, more commonly, with atmospheric precipitation (wet deposition). These radionuclides become part of both abiotic components (soil, water) and biotic components (plants and animals), participating in biological cycles. As a result, radioactive substances can enter the human body through plant-based foods or through animals consuming contaminated feed [6].

Purpose of Radioecological Monitoring

The main objective of radiometric monitoring is to obtain objective information on the impact of radiation on agriculture, livestock, and fisheries, especially in areas located near radiation-hazardous facilities such as nuclear power plants and industrial enterprises emitting harmful substances into the atmosphere [7-8].

Objectives of Veterinary Radiometric Control

1. To identify pathways of radioactive contamination of soil, air, and water bodies by radionuclides.
2. To determine the level of radiation contamination in a given area.
3. To assess the current state and forecast the consequences of radioactive contamination.
4. To develop recommendations for preventing and reducing radioactive pollution in populated areas.
5. To develop measures aimed at limiting the transfer of radionuclides into animal feed and the human food chain [9].

Research Context

Based on the above objectives, scientific research was conducted by specialists of the Biochemistry and Radiobiology Laboratory of the Veterinary Research Institute in the Nurobod district of the Samarkand region. This article presents data obtained from radiometric measurements carried out at “Nurobod Meat and Dairy” LLC. The study focused on environmental objects associated with the breeding of fine-wool small ruminants, including drinking water channels, nearby alfalfa fields, and mixed grasslands used as feed resources [10-11].

Materials and Methods

The study was conducted on February 10–11, 2026, at "Nurobod Meat and Dairy" LLC located in the Nurobod district of the Samarkand region. The farm contains 4,715 heads of fine-wool small ruminants (Boyat breed).

Samples were collected from drinking water canals, nearby alfalfa fields, mixed grasslands, and soil. All sampling procedures were carried out in the presence of the farm director, Rasulov Muhamatali, and officially documented.

Results

Radiometric Measurements Results

The radiometric monitoring conducted across the farm and pasture areas revealed a relatively stable and low-level radiation background, with all measured values remaining within the range typical for natural environmental conditions. The obtained data allow for a detailed interpretation of spatial radiation distribution, environmental safety, and potential implications for agricultural and veterinary activities [12].

1. Spatial Distribution of Radiation Levels

The results from Table 1 indicate that radiation dose rates varied between 12.3 μR/h and 17.8 μR/h across different functional zones of the farm. The highest value (17.8 μR/h) was recorded at the control plot (100×100 m), measured using the envelope method. This slightly elevated value can be explained by natural geochemical characteristics of the soil, including possible accumulation of radionuclides such as uranium, thorium, and potassium isotopes.

Table 1. Radiation Dose Measurements At Different Locations.

No	Location / Object	Measurement Method	Average Dose (μR/h)
1	Alfalfa field (10 points)	Envelope method	15.3
2	Farm entrance (after disinfection barrier)	Point measurement	16.0
2a	Entrance to animal housing	Point measurement	15.7
2b	Feeding section	Point measurement	15.8
2c	Pond water	Point measurement	12.3
2d	Feed storage	Point measurement	14.2
3	Control plot (100×100 m, 6 points)	Envelope method	17.8

In contrast, the lowest radiation level (12.3 μR/h) was detected in pond water, which is consistent with the known attenuating effect of water on gamma radiation. Water bodies typically act as natural shields, reducing external radiation exposure due to absorption and scattering processes [13-14].

The alfalfa field (15.3 μR/h) and feeding section (15.8 μR/h) showed moderate radiation levels, suggesting that plant biomass and agricultural substrates do not significantly accumulate radioactive contaminants under current conditions. Similarly, the feed storage area (14.2 μR/h) remained within safe limits, indicating no radiological risk associated with stored feed. The farm entrance and animal housing zones (15.7–16.0 μR/h) demonstrated slightly elevated but still

acceptable values. These areas are subject to more frequent human and animal activity, which may contribute to minor variations due to soil disturbance and dust resuspension.

Measurement Conditions

- Weather conditions: cloudy
- Ambient temperature: +16°C
- Measurement height: 1 meter above ground
- Distance from the object surface: 5–9 cm
- Soil condition: flat surface

Field Gamma Radiation Measurements

Subsequently, external gamma radiation was measured in a 100 × 100 m pasture area with a flat terrain [15]. Gamma radiation measurements conducted in the pasture area revealed dose rates ranging from 10.3 μR/h to 13.0 μR/h, which are lower than those observed within the farm infrastructure. The highest value (13.0 μR/h) was recorded at the elevated point of the terrain, while the lowest (10.3 μR/h) was at the central point.

Dosimetry was carried out using the envelope method at 7 measurement points.

Table 2. Gamma Radiation Dose Levels In Pasture Area.

Measurement Point	Location Description	Dose Rate (μR/h)
1	Highest point of field	13.0
2	Central point	10.3
3	Lower point	12.3
4–7	Other control points (average)	11.8

Radiation intensity was approximately 3 × 10⁻⁶ (relative unit) across the measurement area.

Discussion

The results of the radiometric monitoring indicate that the investigated farm and pasture ecosystems are characterized by a stable and low-level radiation background, which corresponds to natural environmental conditions. The measured dose rates across all observation points (10.3–17.8 μR/h) fall within the typical global range of background gamma radiation, confirming the absence of significant radiological anomalies.

The slight variations observed between different locations can be attributed primarily to natural environmental factors rather than anthropogenic contamination. For instance, higher radiation levels recorded at the control plot and elevated terrain points are likely associated with geochemical composition of soils, particularly the presence of naturally occurring radionuclides such as uranium, thorium, and potassium-40. In contrast, lower radiation values detected in pond water and lowland areas can be explained by the attenuation effect of moisture and water, which reduces gamma radiation intensity.

The comparison between farm infrastructure zones and open pasture areas reveals that radiation levels are generally higher in farm-related sites. This may be due to increased soil disturbance, accumulation of dust particles, and the presence of construction materials that can slightly

influence gamma background levels. However, these differences are minimal and remain within safe limits.

Additionally, the measurement conditions (standardized height, controlled distance, stable weather, and flat terrain) ensured methodological consistency, enhancing the accuracy and comparability of the results with international radiological monitoring standards.

Overall, the discussion confirms that the investigated area represents a radiologically safe environment, with radiation levels governed by natural background processes. These findings are consistent with previous studies in similar agro-ecological regions and support the conclusion that no additional radiation protection measures are required under current conditions.

Conclusion

The conducted veterinary radiometric monitoring at "Nurobod Meat and Dairy" LLC in the Nurobod district of the Samarkand region provided comprehensive data on the radiation status of environmental objects associated with livestock production. The study included measurements of external gamma radiation as well as laboratory analysis of soil, water, feed, and vegetation samples.

The obtained results demonstrated that the radiation dose rates across all studied locations—alfalfa fields, pasture areas, farm facilities, water sources, and feed storage—remained within the limits of natural background radiation. The measured values, ranging approximately from 10.3 to 17.8 μR/h, did not indicate any abnormal or anthropogenic radioactive contamination. Furthermore, the applied radiometric monitoring methodology, including the use of the envelope method and multi-point measurements, proved to be effective in assessing the spatial distribution of radiation within the farm territory. The consistency of measurements under controlled environmental conditions enhances the reliability of the obtained data. From a veterinary and ecological perspective, the results indicate that the studied territory is radiologically safe for agricultural use, including livestock breeding and feed production. No immediate or long-term radiological threats to animals, farm workers, or consumers of animal products were identified.

In conclusion, the findings of this study confirm that the "Nurobod Meat and Dairy" LLC operates under environmentally safe radiological conditions, and the produced livestock products can be considered safe for consumption in terms of radiation hygiene standards.

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