RADIATION DOSES RECEIVED DUE TO ENVIRONMENTAL POLLUTION AND LEGAL MEASURES REGULATING THE EMISSION OF RADIOACTIVE MATERIALS INTO AIR AND WATER BODIES

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Introduction

Radiation exposure caused by environmental contamination is a major public health concern. Radioactive materials (RMs), released into the atmosphere or hydrosphere, can accumulate in living organisms, increasing the internal and external dose burden. Inhabitants residing near nuclear facilities, industrial waste zones, or polluted rivers are at risk of long-term exposure. Global organizations such as the ICRP and WHO have emphasized the need for hygienic measures and legal controls to prevent harmful exposure.

Methods

A cross-sectional descriptive-analytical methodology was employed. Radiation dose levels were obtained from regional environmental reports and cross-checked with WHO and IAEA standards. The annual effective dose was calculated based on ICRP dose conversion coefficients. Legal analysis included the review of Uzbekistan's Law on Radiation Safety and international safety protocols. Water and air samples from 3 industrial zones in the Fergana Valley were included. Data were analyzed using SPSS software version 25.0.

Results

The mean annual effective dose of radiation among residents living within a 10 km radius of RM-emitting facilities was found to exceed the ICRP-recommended limit of 1 mSv/year. The data is summarized in the table below:

Table 1: Average Annual Effective Radiation Dose in Selected Industrial Zones (Fergana Valley, 2023)

Zone	Airborne RM Dose (mSv/year)	Waterborne RM Dose (mSv/year)	Total Dose (mSv/year)
Zone A	1.4	0.6	2.0

Zone	Airborne RM Dose (mSv/year)	Waterborne RM Dose (mSv/year)	Total Dose (mSv/year)
(Kokand)			
Zone B (Margilan)	1.1	0.4	1.5
Zone C (Fergana)	1.7	0.9	2.6

The most prevalent isotopes were Cesium-137, Radon-222, and Strontium-90. Air emissions were primarily from industrial combustion processes, while water contamination stemmed from unfiltered industrial discharge. Despite existing legal frameworks, several monitoring gaps and enforcement challenges were identified, especially in remote or underfunded areas.

Discussion

Chronic low-dose exposure to ionizing radiation can lead to a gradual increase in the incidence of cancer, particularly leukemia and thyroid malignancies. Children and pregnant women are most vulnerable. Although Uzbekistan has adopted legal frameworks like the Law on Radiation Safety (2000), implementation remains inconsistent due to limited technical resources, outdated monitoring equipment, and lack of trained personnel in radiation hygiene. Strengthening legal mechanisms with modern hygiene-based interventions is essential. Moreover, public health education campaigns are required to reduce unnecessary exposure.

Conclusion

Environmental radiation exposure in certain industrial regions of Uzbekistan surpasses internationally recommended limits. This is attributed to both airborne and waterborne RM emissions. Existing legal acts provide a foundation for control, but enforcement must be enhanced through hygienic surveillance, technological investment, and stricter emission control standards. Integration of public health and environmental monitoring is critical to reduce the radiation dose burden.

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