



MANUFACTURING TECHNOLOGIES AND WASTE RECYCLING

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TTP TRANS TECH PUBLICATIONS

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Ensuring Radiation Safety of Substances Contaminated by Radionuclides by Mixing Them

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Keywords: radiation safety, decontamination, radioactively contaminated substances, mixing.

Abstract. This paper demonstrates the feasibility of ensuring radiation safety of solid substances that comprise environmental objects and have surfaces contaminated with radioactive substances. The identified problem is solved by utilizing the natural property of anti-radiation self-protection.

To reintroduce structures and buildings contaminated with radionuclides into economic circulation, it is recommended to dismantle them, grind the materials, and mix the resulting mass. The proposed method is made possible by transforming the surface contamination of these objects into a uniform distribution of radionuclides throughout the mass of the contaminated substance. This uniform distribution will remain consistent in products made from the received raw materials.

By implementing this approach, it is feasible to reintroduce large volumes of radioactively contaminated materials into the economic cycle and dispose of them in contaminated areas.

Introduction

During production activities, decommissioning, and accidents at nuclear energy facilities, environmental facilities are contaminated with radionuclides. Monitoring and control of pollution of water resources [1], landfills soils [2], and their cleaning are urgent tasks [3]. In the case of nuclear power plant accidents, zones with a high concentration of radionuclides can be created, contaminating residential, administrative, and industrial buildings and structures, vehicles, technological equipment, and machinery used in the elimination of the consequences of accidents [4, 5].

Cesium-137, a source of dangerous gamma radiation, is the primary cause of contamination in territories and objects. When the contamination exceeds the permissible level, the affected objects cannot be used for their intended purpose and must be removed from circulation. This presents a number of challenges, including the organization of utilization, storage, and burial, as well as ensuring the safety of personnel and the prevention of additional radiation pollution in the surrounding natural environment. These tasks require significant financial and material resources.

Therefore, the elimination of radiation accidents and the cleaning of territories and objects from radionuclides to enable their further use in industry, construction, and other human activities as secondary raw materials is becoming increasingly important. This is essential to ensure national security and prevent potential attackers from using nuclear waste for blackmail.

The Main Part

To return substances contaminated with radionuclides to economic circulation, it is necessary to create conditions that protect people from the harmful effects of external sources of ionizing radiation. According to [6], one of the basic principles of radiation safety and anti-radiation protection, particularly during the late phase of a communal radiation accident, is to limit individual exposure dose using anti-radiation measures. Decontaminating territories, buildings, and structures by removing radionuclides that contaminate their surfaces is one of the basic countermeasures.