

ANALYSIS OF THE STATE OF NORMATIVE REGULATION IN THE MANAGEMENT OF LOW-LEVEL WASTES

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UDC 574:539.1.04+621.039.7

It is shown on the basis of an analysis of regulatory-legal documents that the assumptions characterizing very low-level wastes contain semantic contradictions and critical discrepancies of a classification nature regarding wastes containing natural radionuclides and are not consistent with the absolute values of the bounding indices – the dose rates and specific activity. The presence of these uncertainties and inconsistencies in the regulatory documentation makes reaching the primary objective of introducing very low-level wastes as a category – reduction of the cost of managing wastes by lowering the requirements for their isolation – problematic. Some variants of the elimination of normalization shortfalls are proposed.

The category ‘very low-level wastes’, which has been harmonized on an international level, was introduced in our country in 2010 in order to lower the requirements of isolation of these wastes and thereby lower the cost of disposal [1, 2]. However, the expectations associated with the possibility of cost optimization were not justified, since the requirements and disposal tariffs for such wastes are the same as for low-level wastes [3, 4]. This situation does not suit the operating organizations, budget-financing managers, or private investors and can cast doubts on the meaningfulness of the actions taken by regulators. For this reason, there are grounds for expecting changes to be made in the corresponding regulatory-legal acts for which an analysis of the definitions and quantitative indicators of very low-level wastes, the results of which are presented below, could be helpful.

The data in Table 1 demonstrate the inconsistency of the regulatory indicators characterizing very low-level wastes. The regulator explains the discrepancies by the difference of the key definitions: if the regulatory document [2] pertains to very low-level wastes, then [5, 6] pertain to very low-level radioactive wastes. However, it is easy to see that in the expected context very low-level wastes are active exclusively and only because they are radioactive. No other meaning fits the concept ‘very low-level’ [2]. On the basis of the same considerations, the concept ‘radioactive’ introduced in the definition given in [5, 6] is superfluous – the term ‘very low-level’ already characterizes the nature of the possible danger (radioactivity) posed by these wastes. In other words, neither the separation of very low-level wastes into two subclasses [2] and [5–8] nor their unification with low-level wastes [3, 4] has reasonable validation. In addition, it is obvious that the disbalance associated with the introduction of the category ‘very low-level wastes’ must be eliminated.

A reasonable and logically justified variant is to replace the concept (category) ‘very low-level wastes’ by industrial wastes from NPPs with an elevated content of technogenic radionuclides by making the appropriate changes in the regulatory document [2]. An elevated content can be bounded by the same normatively secured indicators that are used now [2]:

- the ambient equivalent dose rate of γ -radiation – 0.1–1 $\mu\text{Sv/h}$ at distance 0.1 m from a surface;
- the total specific heat, Bq/g: 0.3–100, 0.3–10, 0.3–1 for β - and α -emitting and transuranium radionuclides, respectively.

This normalizing maneuver would make it possible to eliminate the reasons for the polysemy in the interpretation of very low-level wastes and, mainly, to remove the industrial wastes from NPPs with elevated content of technogenic radionuclides from the class-4 radwastes category [3].

TABLE 1. Normatively Secured Characteristics of Very Low-Level Wastes

Indicators for classing wastes as very low-level	Normalized indicators according to documents		
	SP 2572-2010 [2]	OSPORB-99/2010 [5], SPORO-2002 [6]	PP No. 1069 [3], MP No. 89 [4]
Dose rate, $\mu\text{Sv/h}$	0.1–1	1–30	–
Specific activity, Bq/g:			
β -emitting	Up to 100	Up to 1000	Up to 1000
α -emitting	Up to 10	Up to 100	Up to 100
transuranium	Up to 1	Up to 10	Up to 10
Nature of the wastes	Industrial wastes from NPPs containing technogenic radionuclides	Solid wastes containing technogenic and natural radionuclides	Class-4 solid and solidified wastes containing natural radionuclides

In contrast to low-level wastes which are classified in accordance with the classification scheme of [3] in the same class-4 wastes category, for industrial wastes from NPPs (very low-level wastes in the present classification) conditioning is not obligatory; container-less storage, transport, and disposal is permitted in specially segregated sections for the disposal of industrial wastes outside NPP sites or in disposal points located on the grounds of NPP [2, 7, 8]. Such legislatively established features of the management of industrial wastes, whose volume can reach 80% or more of the total amount of wastes formed during the liquidation of an NPP [9], make it possible to secure more than a substantial reduction of the NPP decommissioning costs [10]. The same considerations are also valid for other large objects which are especially radiation and nuclear hazardous. For this reason, it has not been ruled out that the recommended correction of the definition of very low-level wastes in the sanitary regulations [2], whose requirements pertain only to NPP wastes, could be insufficient.

For the second subclass of very low-level wastes containing technogenic radionuclides (very low-level wastes in the interpretation given in [3, 4] and very low-level radioactive wastes in the interpretation given in [5, 6]) the positions of the regulator and operator can be harmonized in two ways:

1) combine the subclasses, expanding the boundaries of the categories of the industrial wastes with an elevated content of technogenic radionuclides in terms of the specific activity, for example, to 1000 Bq/g for β -emitting and the dose rate to 30 $\mu\text{Sv/h}$ for γ -radiation [5, 6]; formally, this approach is consistent with legislative requirements [7, 8] and with the initial logic of introducing the category of very low-level wastes but could require additional conclusions drawn by experts about the admissibility of the disposal of such wastes on specially segregated sections of disposal sites for industrial (nonradioactive) wastes;

2) in the alternative approach, the second subclass of very low-level wastes [5, 6] is not removed from the class-4 category of radioactive wastes subject to disposal [3, 4] but the management of such wastes is regulated by, aside from par. 4 (p. 12) of [8], the criteria for the acceptability of radioactive wastes for disposal [10], in which important features must be recorded, such as non-obligatory conditioning and the possibility of storage without the use of containers or using light storage containers, transport and disposal of very low-level wastes together with low-level wastes or in specially created near-surface repositories arranged on the same level as the ground surface; on the whole the economic effect due to the introduction of the category of very low-level wastes decreases, but only very little since the tariff fraction [4] in the total cost of preparation, transport, and disposal of class-4 wastes does not exceed 10%, while the cost of conditioning, including the placement of the wastes in nonreturnable protective containers, can reach 70% or more [11–13].

The situation in managing wastes containing natural radionuclides is different. From the practical, more precisely, pragmatic, standpoint, the question of the disposal of such wastes has been solved rationally. In accordance with the requirements of [3, 4, 8], the radioactive wastes formed during the production and reprocessing of uranium ores as well as in performing activities not associated with the use of atomic energy involved in the production and processing of mineral and organic raw materials with elevated content of natural radionuclides can be placed on disposal sites located on the grounds of organizations where such radioactive wastes are formed [7]. The tariff for the disposal of these wastes is a factor of 113

lower than for class-4 wastes, including very low-level wastes [4]. On-site disposal of wastes by closing (sealing) the tailings storage for mining-enrichment combines requires permission from the government of the Russian Federation. It is obvious that the extraction and transport of wastes containing natural radionuclides involve additional expenditures and radiation risks. Considering the volume of the existing accumulated wastes and their production rates, which exceed $1 \cdot 10^6 \text{ m}^3/\text{yr}$, these risks and costs will be significantly greater than for on-site disposal. In addition, the prospects for restoring the environmental quality of the decommissioned tailings storage is completely devalued by the need for eternal exclusion of the territories of the centralized waste repositories that will have to be created at the sites where economic activity is occurring or could occur in the future. Thus, the legislatively secured possibility for the on-site disposal of wastes containing natural radionuclides is logically substantiated, and there are no serious grounds for revising the solution adopted.

On this level, the ruling fixed in paragraphs 3.12.3 of [5] and 3.4 of [6], according to which solid radioactive wastes containing natural radionuclides are classed as very low-level wastes is unexpected and significantly disorienting. In the first place, the ruling [5, 6] contradicts the criteria established for waste classification by a higher-level document – a resolution of the Government of the Russian Federation [3]. According to [3], wastes containing natural radionuclides are class-6 wastes and not ‘very low-level’ wastes.

Other inconsistencies could also be mentioned. For example, in the ruling [5, 6] the wastes are depleted according to a single indicator, viz., the presence of natural radionuclides irrespective of the concentration (specific activity). But, if this is the case, then the concept ‘very low-level wastes’ is physically meaningless. In paragraph 5.2.9 [5], it is asserted that production wastes with effective specific activity of natural radionuclides exceeding 10 kBq/kg are buried in a manner that meets the requirements established for the disposal of low-level wastes, i.e., solid wastes containing natural radionuclides, contrary to the position in paragraph 3.12.3 [5], are not necessarily very low-level wastes. These discrepancies must be eliminated with all requirements of the form and content of the government acts regulating the management of biologically hazardous wastes from technogenic activity being met.

Conclusion. According to the foregoing analysis, the indicators characterizing very low-level wastes contain semantic uncertainties that make problematic the possibility of reaching the primary objective of introducing the category of very low-level wastes – a reduction of the costs at the final stage of the life cycle of the wastes by lowering the requirements of their isolation from the biosphere. This is highly significant especially in the face of the massive decommissioning of nuclear and radiation hazardous objects.

This work was performed in fulfillment of the state order 2014/191, NIR No. 651, from the Ministry of Education and Science of the Russian Federation.

REFERENCES

1. *Classification of Radioactive Wastes, No. GSG-1*, IAEA, Vienna (2009).
2. SP 2.6.6.2572–2010, *Radiation Safety Security in Managing NPP Commercial Wastes Containing Technogenic Radionuclides*, Rospotrebnadzor, Moscow (2010).
3. “On the criteria for classing solid, liquid, and gaseous wastes as radwastes, criteria for classing radwastes as special radwastes and disposable radwastes, and criteria for classing disposable radwastes,” in: *Collection of the Laws of the Russian Federation*, Oct. 29, 2012, No. 44, Art. 6017.
4. “Tariffs for the disposal of radioactive wastes during the first period of regulation – Order No. 89, March 13, 2013, of the Ministry of the Environment of the Russian Federation,” *Ross. Gazeta*, June 5, 2013, No. 6095.
5. SP 2.6.1.2612–10, *Primary Sanitary Regulations for Securing Radiation Safety (OSPORB–99/2010)*, Ver. No. 1, appr. by Ruling No. 43, Sept. 16, 2013, of the Surgeon General of the Russian Federation, Ministry of Justice Reg. No. 30309, Oct. 15, 2013, Rospotrebnadzor, Moscow (2013).
6. SP 2.6.6.1168–02, *Sanitary Regulations for Managing Radwastes (OSPORO–2002)*, Ver. No. 2, appr. by Ruling No. 43, Sept. 16, 2013, of the Surgeon General of the Russian Federation, Ministry of Justice Reg. No. 30309, Oct. 15, 2013, Rospotrebnadzor, Moscow (2013).

7. *Commentary to the Federal Law On Managing Radwastes and Making Changes in Individual Legislative Acts of the Russian Federation*, GD RF, Moscow (2014).
8. "Federal Law *On Managing Radwastes and Making Changes in Individual Legislative Acts of the Russian Federation*, No. 190, July 11, 2011," in: *Collection of the Laws of the Russian Federation*, July 18, 2011, No. 29, Art. 4281.
9. IAEI-TECDOC-1322, *Decommissioning Costs of WWER-440 Nuclear Power Plants*, IAEA, Vienna (2002).
10. "Acceptability criteria for radwastes for disposal," *Yad. Radiats. Bezopas.*, No. 1(7), 22–35 (2014).
11. A. F. Nechaev and I. V. Smirnov, *Economics of the Final Stage of the Life Cycle of Nuclear and Radiation Hazardous Objects*, ID Infro Ol, St. Petersburg (2014).
12. A. F. Nechaev and A. S. Chugunov, "Motivation and possibilities of reducing the volume of radwastes," *At. Énerg.*, **115**, No. 6, 318–320 (2013).
13. G. P. Nassonov and A. F. Nechaev, "Economic aspects of the 'neutralization' of radwastes," *Izv. SPbGTI*, No. 24(50), 93–97 (2014).

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