

ABOUT THE IDEAS ON EXPANDING THE RW MANAGEMENT SYSTEM TO COVER INDUSTRIAL WASTE CONTAINING MAN-MADE RADIONUCLIDES

Abramov A. A.¹, Bolshov L. A.², Gavrilov P. M., Dorofeev A. N.¹, Igin I. M.³,
Linge I. I.², Mokrov Yu. G.⁴, Pechkurov A. V.⁵, Utkin S. S.²

¹State Corporation Rosatom, Moscow, Russia

²Safety Institute of RAS, Moscow, Russia

³FSUE National Operator for Radioactive Waste Management, Moscow, Russia

⁴FSUE Production Association Mayak, Ozersk, Russia

⁵JSC Rosenergoatom Concern, Moscow, Russia

Article received on December 2, 2019

The article focuses on alterations to be introduced to radioactive waste classification system concerning the criteria used to assign waste to the radioactive waste category. It presents a critical analysis of proposals on considering industrial waste containing man-made radionuclides within the scope of radioactive waste management activities. The paper provides evidence demonstrating the infeasibility of proposed alterations both from financial and radiation safety perspective. According to the authors, if this proposal is approved, it impedes the development of the unified state system for radioactive waste management.

Keywords: *radioactive waste, industrial waste containing man-made radionuclides, criteria used to assign waste to radioactive waste category, regulation, system for radioactive waste management.*

It's believed that provisions of the Government Resolution of the Russian Federation No. 1069 [1] establishing criteria used to assign waste to radioactive waste category (hereinafter referred to as RW), RW to special (non-retrievable) and retrievable RW, as well as setting forth retrievable RW classification system should be reviewed and this need is considered being objective and administratively supported. The work plan approved by the Government provides for such a review in 2020. Potential focus areas of such review were discussed and rationalized at a corporate level during relevant discussions held by scientific and technical councils, working groups and in a number of publications, including some recent ones [2–4]. Practical application

of the Resolution has already revealed a sufficient number of cases when the wordings set forth in the criteria prescribed the implementation of some actions being considered as obviously unprofitable and inflicting increased radiation exposure leading to non-compliance with the optimization principle in the RW management [5]. A case in point, is the provision on assigning accumulated RW of non-defense and non-emergency origin to the retrievable RW category or unnecessarily severe conservatism in waste categorization with no account taken of its radiological impact when it comes to deep geological disposal resulting in higher disposal costs according to relevant disposal tariffs, etc. The results of these studies were summarized in [4]. It

also emphasized the importance of the upcoming period providing for the interagency coordination of the proposed amendments. These amendments discussed at the corporate level, of course, are supported by the authors. Until very recently, it was supposed that these amendments are to be focused exactly on the above, since no practical problems were revealed in terms of criteria used to assign waste to RW category. Even despite the “virtuality” of the criteria established for gaseous waste categorization as radioactive, noting that average annual allowable specific activity for the population is used as a criterion in this case.

However, in a number of recent publications [6, 7] ideas were expressed again on substantial changes to be introduced to the criteria used to categorize solid waste as radioactive, providing that industrial waste with a high content of man-made radionuclides (VLLW) is considered under the RW management framework. These ideas are not new: they have been cultivated for a long time by VNI-IAES experts [8] starting from the period when the main provisions of the RW management law had emerged. It should be clarified that specific activity of man-made radionuclides contained in VLLW is lower than the SRW criterion, but at the same time does not allow its clearance from radiation control imposing certain restrictions on its treatment.

Main arguments against the idea of expanding the scope of USS RW

First of all, it should be noted that a comprehensive rationale behind the proposed extension is missing. This point was best formulated by the authors in the conclusions of their article [6]: “In order to adopt a balanced, safe and economically viable option, it seems advisable to conduct a comprehensive feasibility study of the current state and prospects for VLLW management (including those generated from nuclear decommissioning) accounting for different VLLW statuses. As such studies are not available, it seems preferable to classify VLLW as radioactive waste, as recommended by IAEA standards and acknowledged by leading nuclear countries around the world.” Arguments regarding the IAEA standards and the nuclear countries will be discussed later. First, the essence of the proposal should be explained: in other words it can be formulated as follows: “We don’t want to do the analysis on our own and don’t want to wait for the completion of the ongoing work performed by the State Corporation Rosatom. [6] Therefore, let’s conduct a large-scale field experiment embracing the nuclear industry and the country as a whole.” It should be noted that these ideas can be evaluated

positively only by specialized organizations providing services in the field of RW management, i.e. by direct beneficiaries. The situation is more than understandable: a large amount of new activities being considered as radiation-safe emerges.

As radiation protection experts, practitioners responsible for USS RW operation in general and large operating organizations being the main RW generators are deeply convinced in the harmful nature of such proposals, it prompted them to formulate the main counterarguments regarding the following three aspects:

- radiation safety and compliance with international requirements;
- additional costs covered by the federal budget and funds of operating organizations;
- disproportionate burden of responsibility.

International radiation safety requirements

Authors of the unfeasible idea appeal to the need of complying with international requirements. However, we believe that such a compliance implicitly exists. Questioning such compliance seems to be untenable for at least three reasons.

Firstly, IAEA documents are being misrepresented as binding. In fact, their provisions should be used by countries during the development of their national regulatory requirements, given the specific aspects of the existing practice. As a confirmation, two quotes from IAEA Safety Guide “Classification of Radioactive Waste” (No. GSG-1) [10] should be cited:

“2.32. The precise criteria according to which waste is assigned to a particular waste class will depend on the specific situation in the State in relation to the nature of the waste and the disposal options available or under consideration”;

“Appendix A.5. The classification scheme developed in this publication is intended to provide a framework for defining waste classes within national waste management strategies and to serve as a tool for facilitating communication on radioactive waste safety. The boundaries between the classes are not intended to be seen as hard lines, but rather as transition zones whose precise determination will depend on the particular situation in each State.”

Secondly, an incorrect reference is made to the IAEA document “Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards” (GSR Part 3) [11] as a document establishing the criteria for solid waste assignment to RW category. Appendix I of GSR Part 3 and Table I-2, in particular, provides levels for exemption of bulk amounts of solid material without further consideration and for clearance of solid material

without further consideration for activity concentrations of radionuclides of artificial origin which is not equal to waste assignment to RW category. Moreover, levels provided in Table I-2 should be not considered as unambiguous and absolute. Literally [11] indicates the following: “3.12. *The regulatory body shall approve which sources, including materials and objects, within notified or authorized practices may be cleared from regulatory control, using as the basis for such approval the criteria for clearance specified in Schedule I or any clearance levels specified by the regulatory body on the basis of these criteria.*” As stated in Schedule I “*Clearance may be granted by the regulatory body for specific situations, on the basis of the criteria of paras I.10 and I.11, with account taken of the physical or chemical form of the radioactive material, and its use or the means of its disposal. Such clearance levels may be specified in terms of activity concentration per unit mass or activity concentration per unit surface area*” with a footnote stating that, for example, specific clearance levels may be developed for metals, for rubble from buildings and waste for disposal in landfill sites.

Reference to GSR Part 3 [11] demonstrates that the authors of the proposals actually recognize the radiation safety system as being equal the RW management system. However, it's believed that there are some fundamental differences between these systems. The radiation safety system is considered as a comprehensive one with its boundaries being immediately represented by clearance and exemption levels. It features a wider range of tools, including permissive and restrictive ones. Radioactive waste is a hazardous waste with a single solution available to ensure their safety (disposal) and many exclusive components — single organization responsible for RW disposal, mandatory payments to cover disposal costs, including pre-payment mechanisms, etc. Therefore, in general, a boundary set for clearance (or exemption) from regulatory control (both for small and large volumes of waste) should not necessarily correspond to the one set for RW classification purposes. A situation when the levels for waste assignment to RW category do not coincide with the exemption ones does not contradict the IAEA recommendations. Surely, regulatory body, Rospotrebnadzor in Russia, can make them identical if it complies with the national waste management practice. But this is obviously not the case of Russia, since Russia is not a country developing nuclear power industry from scratch. We have a background involving over 60 years of NPP operation and, more importantly, the one of nuclear defense complex operation.

Thirdly, in 2015 and 2018, current criteria used to assign waste to the RW category were presented

under the National Reports of the Russian Federation on the fulfillment of obligations arising from the Joint Convention on the Safety of Spent Fuel Management and on the Safety of Radioactive Waste Management [12] (ratified by the Russian Federation in 2005). Over the years, not a single question or a remark was posed by the international community regarding the contents of the criteria. One more time let's stress that this is attributed to the fact that radiation safety requirements are not limited to the requirements for the RW management system. This situation seems to be a common one for many countries.

Thus, there is no reason to refer to the given values as to “consolidated internationally accepted” criteria for solid waste assignment to the radioactive waste category and to state that the current version of the Government Resolution of the Russian Federation No. 1069 does not comply with them.

The authors appeal to far-fetched hygienic concerns. For example, page 3 of the same article [6] provides the following “strong” example: “*if the specific activity of ^{60}Co in the waste is close to 10 kBq/kg (maximum allowable specific activity of this radionuclide in VLLW), then the dose rate from such wastes can reach 5 $\mu\text{Sv/h}$, which is about 25–50 times higher than the radiation background in the European part of Russia, and the annual effective dose to a person can be several millisievert if no adequate safety measures are taken.*” Many points remain beyond the scope of this argument, including the fact that activation product and strong gamma-emitter cannot stand alone, and if it is surrounded by other radionuclides of similar origin, its maximum allowable activity should be much lower, otherwise this material should be assigned to RW category. Similar examples can be found in the Chernobyl experience, when the calculations provided for the intake of radionuclides within the entire food ration along the upper limit of maximum allowable levels with relevant restrictions and exclusion values being derived on its basis. It resulted in a conclusion of the International Chernobyl Project [13], which concentrated an unprecedented potential of top-level experts, stating that: “*Protective measures taken or planned in the long term, although based on good intentions, generally go beyond of what was strictly necessary as regards radiation protection. Resettlement and food restriction measures should have been taken on a smaller scale.*”

A repeated appeal to the need of implementing radiation protection measures in relation to VLLW is believed to be generally inappropriate and far-fetched, since the main measure has already been implemented: waste is not cleared from radiation control and the system of sanitary rules in the field of radiation safety is in place.

Additional costs covered by the federal budget and the funds of operating organizations

Firstly, the scope of tasks in the field of accumulated RW management that cannot be addressed without proper funding from the federal budget should be considered: it is huge and requires certain measures to be taken to ensure the safety of over 150 facilities with accumulated RW in each of them exceeding the activity of the entire VLLW inventory. This circumstance was the main reason why VLLW challenges were never considered as critical [14, 15]. Moreover, federal budget funds are limited, thus, expenses on VLLW can be literally seen as “wasteful” spending that cannot be supported by enterprises with their large-capacity RW storage facilities.

Estimates of waste volume, data on waste sites, rates of waste generation and accumulation are not available to the authors of the idea due to the lack of relevant reliable data recorded in the state accounting systems. However, based on our experience in NPP operation and nuclear legacy decommissioning, we can state that the total volume of such waste lies in the range of tens – hundreds of millions of tons. Such significant RW volumes requiring disposal as RW were not provided for under USSR RW framework and will require some significant siting efforts to select suitable location for relevant disposal facilities, to solve logistics problems, etc.

At the same time, increased efficiency of VLLW disposal is seen as an urgent task both in terms of accumulated and newly generated RW. For this purpose, it is supposed to allocate VLLW into a separate class with significantly lower tariff for its disposal and particular legislative provisions being in place allowing large operating organizations to implement VLLW disposal at their own industrial sites. This, in turn, will provide operating organizations with the opportunity: if necessary and on a voluntary basis they will be able to hand over the VLLW for disposal or to dispose the waste on their own. Furthermore, availability of a separate and not burdensome tariff for such waste disposal is seen as a fundamental condition enabling to implement the decision. Such a situation is believed to be much more preferable for enterprises than VLLW inclusion into RW category.

In general, authors of the criticized idea express a quite specific attitude to relevant financial aspects. [6] provides tables indicating the disposal rates for various types of waste, but no conclusion is drawn from these. However, based on the rates a conclusion suggests itself: RW disposal tariffs are significantly higher. And the arguments about the cost of services for the destruction of the marketable

product by crushing or pressing have nothing to do with the issue in question.

To conclude on the financial topic, it should be emphasized that the considered idea seems to be ruinous both for the federal budget and for operating organizations.

Disproportionate burden of responsibility

Most recent publication elaborating on the idea under consideration [6], states that “the Russian waste management system is characterized by a dichotomy suggesting waste splitting into two non-overlapping sets: production and consumption waste (hereinafter, industrial waste) and radioactive waste (hereinafter, RW).” Such a wording encourages an unambiguous perception of this situation as a negative one with relevant ideas on arranging such over-lapping in part of VLLW. In fact, this circumstance is absolutely normal and is believed to be a general approach to legal regulation of relations (Civil Code and Criminal Code). There are even more detailed divisions allowing to apply differentiated requirements, derived, inter alia, based on the hazard level associated with the regulated item (committed violation of the law). Liabilities for their non-compliance are differentiated accordingly. It’s worth recalling a relatively recent case when the head of a large enterprise was prosecuted notably for discharges of radioactive waste that did not produce any impact on the safety of the population. If the criteria for waste assignment to the RW category become stricter, the likelihood of such cases increases in a significant and unpredictable way.

Conclusions

To conclude it seems worth emphasizing once again that the argument suggested by the authors of the idea claiming for VLLW inclusion into USSR RW can be at least viewed as vicious. The task that can be addressed and is already being addressed within the framework of an ad hoc working group established by the State Atomic Energy Corporation Rosatom to implement the approved plan of measures on the State Policy Fundamentals in the Field of Nuclear and Radiation Safety, is proposed to be addressed in a most costly way.

Moreover, the consequences for the industrial enterprises appear to be most severe:

- several fold, but more likely man-fold increase in the amount of payments for RW generation;
- claims may be raised against enterprises for their non-compliance with requirements on the management of accumulated RW characterized with practically unknown volume.

Negative consequences are also predicted for the implementation of measures aimed to enhance nuclear and radiation safety: substantial dispersion of funds will occur.

USS RW evolution will be slowed down as well, since with no formal grounds in place, business entities will obviously opt for the operations involving zero activity waste.

References

1. Postanovlenie Pravitelstva RF ot 19.10.2012 N 1069 «O kriteriyah otneseniya tverdyh, zhidkih i gazoobraznyh othodov k radioaktivnym othodam, kriteriyah otneseniya radioaktivnyh othodov k obyem radioaktivnym othodam i k udalyaemym radioaktivnym othodam i kriteriyah klassifikacii udalazyemyh radioaktivnyh othodov [Decree of the Government of the Russian Federation of 19 October 2012, no.1069 “On the criteria of designation of solid, liquid and gaseous waste as radioactive waste, criteria of radioactive waste designation as special radioactive waste and removable radioactive waste and criteria of classification of removable radioactive waste”].

2. Linge I. I., Samoylov A. A. Vozmozhnosti optimizacii normativnogo regulirovaniya edinoj gosudarstvennoj sistemy obrashcheniya s radioaktivnymi othodami [Potential for Optimization of the Regulatory Framework for the Unified State System of Radioactive Waste Management]. *Voprosy radiacionnoj bezopasnosti — Radiation Safety Issues*, 2016, no.4(84), pp. 12–20. (In Russian).

3. Dorofeev A. N., Linge I. I., Samoylov A. A., Sharafutdinov R. B. K voprosu finansovo-ekonomicheskogo obosnovaniya povysheniya effektivnosti normativnoj bazy EGS RAO [Feasibility study on enhancing the efficiency of USS RW regulatory framework]. *Radioaktivnye othody — Radioactive Waste*, 2017, no. 1, pp. 22–31. (In Russian).

4. Dorofeev A. N. O hode rabot po razvitiyu normativno-pravovoj bazy v oblasti obrashcheniya s radioaktivnymi othodami [On a Workflow for the Regulatory Basis Development in the Realm of RW Management]. *Radioaktivnye othody — Radioactive Waste*, 2019, no.3(8), pp. 6–13. DOI: 10.25283/2587-9707-2019-3-6-13. (In Russian).

5. Federalnye normy i pravila v oblasti ispolzovaniya atomnoj energii «Zahoroneniye radioaktivnyh othodov. Principy, kriterii i osnovnye trebovaniya bezopasnosti» (NP-055-14)/ — Utv. Prikazom Federalnoj sluzhby po ekologicheskomu, tehnologicheskomu i atomnomu nadsoru ot 22.08.2014, no.572. [NP-055-14 Radioactive waste disposal. Principles, criteria and basic safety requirements]. Moscow, 2014. 53 p.

6. Ivanov E. A., Sharov D. A., Kuryndin A. V. Aktual'nye problemy klassifikacii udalyaemyh tverdyh radioaktivnyh othodov, obrazuyushchihysya pri ispol'zovanii

atomnoj energii. [Actual problems of classification of radioactive waste generated during nuclear energy application]. *Yadernaya i radiacionnaya bezopasnost' — Nuclear and radiation safety*. 2018, no. 2 (88). pp. 11–23. (In Russian).

7. Ivanov E. A., Sharov D. A., Demyanenko M. V., Sharafutdinov R. B., Kuryndin A. V. O nekotoryh problemah obrashcheniya s promyshlennymi othodami, sodержashchimi tekhnogennye radionuklidy. [On some problems of treatment of industrial waste containing radionuclides of artificial origin]. *Yadernaya i radiacionnaya bezopasnost' — Nuclear and radiation safety*. 2019, no. 3 (93). pp. 1–11. (In Russian). DOI: 10.26277/SECNRS.2019.93.3.001.

8. Asmolov V. G., Barchukov V. G., Ivanov E. A., Kochetkov O. A. Ochen' nizkoaktivnye othody v sisteme obrashcheniya s radioaktivnymi othodami [Very Low-Level Radioactive Wastes in the Radioactive Waste Management System]. *Rosenergoatom Journal*, 2014, no. 10, pp. 30–33. (In Russian).

9. Rasporyazhenie Goskorporacii «Rosatom» ot 26.08.2019 № 1-1.4/645-R «O sozdanii rabochej gruppy dlya podgotovki predlozhenij po sovershenstvovaniyu normativnogo pravovogo obespecheniya deyatelnosti po obrashcheniyu s promyshlennymi othodami, sodержashchimi radioaktivnye veshchestva v kolichestvah, ne sootvetstvuyushchih kriteriyam otneseniya k radioaktivnym othodam». [Order of the State Corporation Rosatom of August 26, 2019. No. 1-1.4 / 645-R «On the establishment of a working group to develop proposals on improving the regulations covering the management of industrial waste containing radioactive substances in quantities not meeting the criteria enabling it to be categorized as radioactive waste»].

10. General Safety Guide No GSG-1 «Classification of Radioactive Waste». International Atomic Energy Agency, Vienna, 2014.

11. General Safety Requirements Part 3 № GSR Part 3. Radiation Protection and Safety of Radiation Sources: International Basic Safety Standards, IAEA Safety Standards, General Safety Requirements Part 3, No. GSR Part 3, International Atomic Energy Agency, Vienna, 2014.

12. Joint Convention on the safety of spent fuel management and on the safety of radioactive waste management, Vena. — URL: <https://www.iaea.org/sites/default/files/infcirc546.pdf>.

13. Mezhdunarodnyj chernobyl'skij proekt. Tekhnicheskij doklad. Ocenka radiologicheskikh posledstvij i zashchitnyh mer. Doklad mezhdunarodnogo konsul'tativnogo komiteta [International Chernobyl project. Technical report. Assessment of radiological consequences and evaluation of protective measures. Report by an International Advisory Committee] / Published by the IAEA in Vienna 1992. 740 p.

14. The problems of the nuclear legacy and the ways of their solutions. Edited by A. M. Agapov,

L. A. Bolshov, E. V. Evstratov, N. P. Laverov, I. I. Linge. [Nuclear legacy issues and their solutions. – Under general ed. of Evstratov E. V., Agapov A. M., Laverov N. P., Bolshov L. A., Linge I. I.]. – Moscow, JSC Energopromanalitika Publ., 2012, vol. 1, 356 p. (In Russian).

15. Abramov A. A., Dorofeev A. N., Komarov E. A., Kudryavtsev E. G., Bolshov L. A., Linge I. I., Abalkina I. L., Biryukov D. V., Vedernikova M. V.,

Khamaza A. A., Sharafutdinov R. B., Bochkarev V. V. K voprosu ocenki ob"ema yadernogo naslediya v atomnoj promyshlennosti i na inyh ob"ektah mirnogo ispol'zovaniya atomnoj energii v Rossii [Concerning the evaluation of nuclear legacy volume in the nuclear industry and other facilities of nuclear energy peaceful use in Russia]. *Yadernaya i radiacionnaya bezopasnost'* – *Nuclear and radiation safety*. 2014, no.3(73). pp. 3–13. (In Russian).

Information about the authors

Abramov Aleksandr Anatolyevich, Deputy Director for the Public Policy on Radioactive Waste, Spent Nuclear Fuel and Nuclear Decommissioning – Head of the Department for the Development and Implementation of Nuclear Legacy Remediation Programs, State Corporation «Rosatom» (24, Bolshaya Ordynka St., Moscow, 119017, Russia), e-mail: AAAbramov@rosatom.ru.

Bolshov Leonid Aleksandrovich, Member of the Russian Academy of Sciences, Professor, Doctor of Physical and Mathematical Sciences, Head of Research, Nuclear Safety Institute of RAS (52, Bolshaya Tulsкая St., Moscow, 115191, Russia), e-mail: bolshov@ibrae.ac.ru.

Gavrilov Petr Mikhailovich, Doctor of Technical Science, e-mail: atomlink@mcc.krasnoyarsk.su.

Dorofeev Aleksandr Nikolaevich, PhD, Head of the Project Office on the Development of a Unified Radioactive Waste Management System, State Corporation “Rosatom” (24, Bolshaya Ordynka St., Moscow, 119017, Russia), e-mail: ANDorofeev@rosatom.ru.

Igin Igor Mikhailovich, General Director, FSUE NO RAO (49A bld.2, Pyatnitskaya St., Moscow, 119017, Russia), e-mail: info@norao.ru.

Linge Igor Innokentevich, Doctor of Technical Sciences, Deputy Director, Nuclear Safety Institute of RAS (52, Bolshaya Tulsкая St., Moscow, 115191, Russia), e-mail: linge@ibrae.ac.ru.

Mokrov Yuri Gennadievich, Doctor of Technical Science, Science and Ecology Adviser General Director, FSUE Mayak PA (18, Ermolaeva St., Ozyorsk, Chelyabinsk Region, 456780, Russia), e-mail: mokrov@po-mayak.ru.

Pechkurov Andrey Vladimirovich, Doctor of Biological Sciences, Chief Technologist, Department of emergency preparedness and radiation protection of JSC “Concern Rosenergoatom” (3A, Kholodilnyy lane, Moscow, 115191, Russia), e-mail: pechkurov-av@rosenergoatom.ru.

Utkin Sergey Sergeevich, Doctor of Technical Sciences, Head of Department, Nuclear Safety Institute of RAS (52, Bolshaya Tulsкая St., Moscow, 115191, Russia), e-mail: uss@ibrae.ac.ru.

Bibliographic description

Abramov A. A., Bolshov L. A., Gavrilov P. M., Dorofeev A. N., Igin I. M., Linge I. I., Mokrov Yu. G., Pechkurov A. V., Utkin S. S. About the ideas on Expanding the RW Management System to Cover Industrial Waste Containing Man-made Radionuclides. *Radioactive Waste*, 2019, no.4(9), pp. 6–13. DOI: 10.25283/2587-9707-2019-4-6-13. (In Russian).