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THE STATE OF ANIMAL WASTE RENDERING AND DISPOSING SYSTEM IN THE SUBJECTS OF THE RUSSIAN FEDERATION

A. V. Belchikhina[1], M. A. Shibaev[2], I. M. Klinovitskaya[3], A. K. Karaulov[4]

[1] Junior Researcher, FGBI "ARRIAH", Vladimir, Russia, *e-mail: belchihina@arriah.ru; ORCID 0000-0003-1442-2469*

[2] Head of Sector, Candidate of Science (Veterinary Medicine), FGBI "ARRIAH", Vladimir, Russia, *e-mail: shibaev@arriah.ru; ORCID ID 0000-0002-9382-0109*

[3] Senior Researcher, Candidate of Science (Economics), FGBI "ARRIAH", Vladimir, Russia, *e-mail: klinovitskaya@arriah.ru; ORCID ID 0000-0001-5347-8620*

[4] Head of Information Analysis Centre, Candidate of Science (Veterinary Medicine), FGBI "ARRIAH", Vladimir, Russia, *e-mail: karaulov@arriah.ru; ORCID ID 0000-0002-5731-5762*

SUMMARY

Organizations of all forms of ownership engaged in the production, transportation, procurement and processing of animal products and raw materials, as well as backyards, produce a significant amount of biological waste in the course of their activity. This waste is the source of environmental pollution, it contributes to the maintenance of infectious disease outbreaks and poses a real threat to public and livestock health. Facilities for biological waste rendering and disposal require constant monitoring and supervision, because the improper management of these facilities can lead to disease occurrence and spread with significant environmental, economic and social implications. In order to objectively reflect the real state of waste rendering and disposal facilities in the Subjects of the Russian Federation and to form a holistic view of the problem in the country, the analysis of data, collected from the veterinary executive authorities of the Subjects of the Russian Federation, were analyzed. Such parameters as quantity, form of ownership, veterinary and sanitary condition, location and availability of animal waste rendering and disposal facilities were considered as of 2018. The study revealed 20,808 animal waste rendering and disposal facilities registered in the country, the majority of them being represented by animal burial sites (including anthrax). In most cases, animal burial sites (including anthrax) do not meet veterinary and sanitary requirements and are unattended. The analysis reveals tension in the field of animal waste management in the Russian Federation.

Key words: rendering, waste disposal, biological waste, biological waste rendering and disposal facilities, animal burial sites, anthrax animal burial sites, incineration furnaces, veterinary and sanitary rendering plants, veterinary and sanitary condition.

INTRODUCTION

Every year the operations of organizations under various forms of ownership (agricultural production cooperatives, public companies, private limited companies, sole proprietors, etc.) involved into production, transportation, harvesting and processing of animal products and raw materials, as well as backyards generate a significant amount of biological waste, including animal and poultry carcasses, aborted fetuses and still-borns; condemned animal products (meat, fish, other animal products) identified in the course of meat inspections at slaughter houses, meat- and fish-processing plants, markets, traders and other facilities, as well as other wastes, generated by animal products and by-product processing [1, 2, 5, 6]. Biological wastes are the source of environmental contamination; they can maintain infectious disease outbreaks and create a real threat to human and livestock health [5, 6]. In this context, biological waste rendering and disposal facilities require a constant surveillance and control, because the improper management of these facilities can lead to disease occurrence and spread with significant environmental, economic and social implications [3, 4].

Today the official information on this problem is fragmented and scarce, making impossible to obtain the true picture of veterinary and sanitary conditions, maintained at biological waste rendering and disposal facilities as well as to build a holistic view of this problem in the country.

Therefore, the purpose of this work was to select parameters, which would provide the most reliable information about the conditions of the facilities involved into

biological waste rendering; and to gather data and evaluate the data about the situation in the country in 2018.

MATERIALS AND METHODS

For the purposes of the analysis, the FGBI "ARRIAH" specialists developed a data collection form covering such primary parameters as the quantity, type, form of ownership, veterinary and sanitary condition, survey findings and availability of biological waste rendering and disposal facilities in the Subject. The simultaneous data collection using the above form was arranged during the period from January 1, 2018 to January 1, 2019. Primary data, submitted by the officials of executive veterinary authorities of 85 Russian Federation Subjects, were entered into the ASSOL.EXPRESS operational reporting system and analyzed.

Commonly used data analysis methods were used in the study: synthesis and formalization of information; comparative analysis and descriptive statistics. Numeric data were processed using STATISTICA 10 data analysis software (StatSoft, Inc.). With the purpose of obtained data visualization in the form of maps ArcGIS 10.6 geographic information system was used.

RESULTS AND DISCUSSION

Biological waste rendering and disposal system in the Russian Federation

Biological waste rendering and disposal in the Russian Federation are regulated by Veterinary and Sanitary Rules of Biological Waste Collection, Rendering and Disposal No. 13-7-2/469, approved on December 4, 1995 [1].

These Rules describe the procedure of biological waste collection, rendering and disposal both for animal owners (regardless of management practices used) and for organizations and companies under all forms of ownership, involved into production, transportation, storage, harvesting and processing of animals' products and raw materials.

According to veterinary and sanitary rules, biological waste shall be rendered by processing at veterinary and sanitary rendering plants (facilities), burnt in incinerator furnaces and decontaminated in biothermal pits.

It should be noted that disposal of biological waste by burial is strictly prohibited. However, in exceptional cases, for example animal mass mortality due to natural disasters, when it is impossible to transport the carcasses for rendering, incineration and decontamination in biothermal pits, burial of biological waste is permitted at the discretion of the RF Subject Chief Veterinary Officer. It is prohibited to throw biological waste into water bodies, rivers, swamps, dumpsters, transport them to landfill or dump sites [1].

Number, distribution and form of ownership of biological waste rendering and disposal facilities

One of the basic tasks of the RF Subject veterinary service is the official veterinary surveillance and control over different objects. Biological waste rendering and disposal facilities (BWRDF) are also the objects of the official veterinary surveillance, as they play a significant role in disease freedom assurance in the RF Subjects. In this light, the BWRDFs condition was analyzed.

The results of the analysis performed show that as of January 1, 2018 20,808 BWRDFs are registered in the Russian Federation. The majority of BWRDFs is presented by carcass burial sites (68% out of the total number). The lowest number accounts for rendering plants (0.3%), and almost equal propotions stand for the numbers of anthrax burial sites (15%) and inciniration furnaces (16.7%) (Fig. 1).

There are 14,109 carcass burial sites, registered almost in all Subjects of the country, except for Moscow, Saint-Petersburg, Republics of Mariy El and Adygeya, Magadan Oblast and Chukotka Autonomous Okrug. Approximately half of carcass burial sites (40%) are located in the Volga Federal District. This value varies from 11 to 200 in 40 Subjects; and is not more than 10 for 15 Subjects (Fig. 2). The number of the carcass burial sites is not more than 10 in the Republic of Chuvashia, Republic of Ingushetia, Kursk Oblast and in Sevastopol city.

Anthrax burial sites are registered in 61 Subjects with the total amount of 3,193. Half of them is located in the following Subjects: Republic of Udmurtia (101), Kemerovo (103), Tver (145) and Nizhny Novgorod (231) Oblasts, Republics of Mordovia (251), Yakutia (285) and Tatarstan (808).

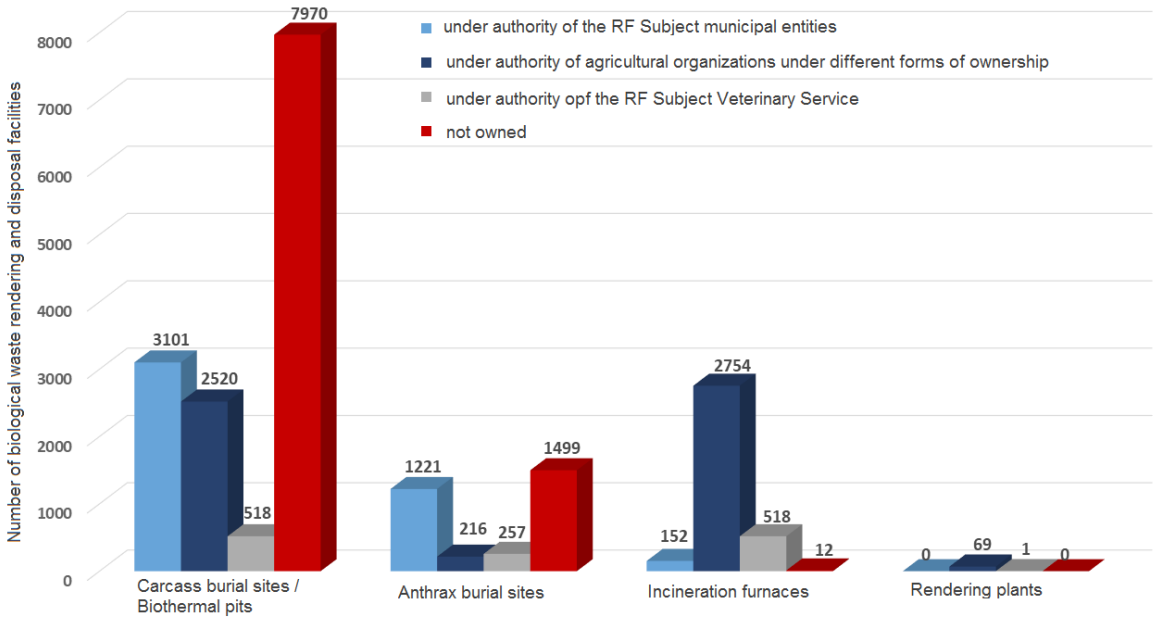


Fig. 1. Total number of biological waste rendering and disposal facilities in the RF (as of 2018)

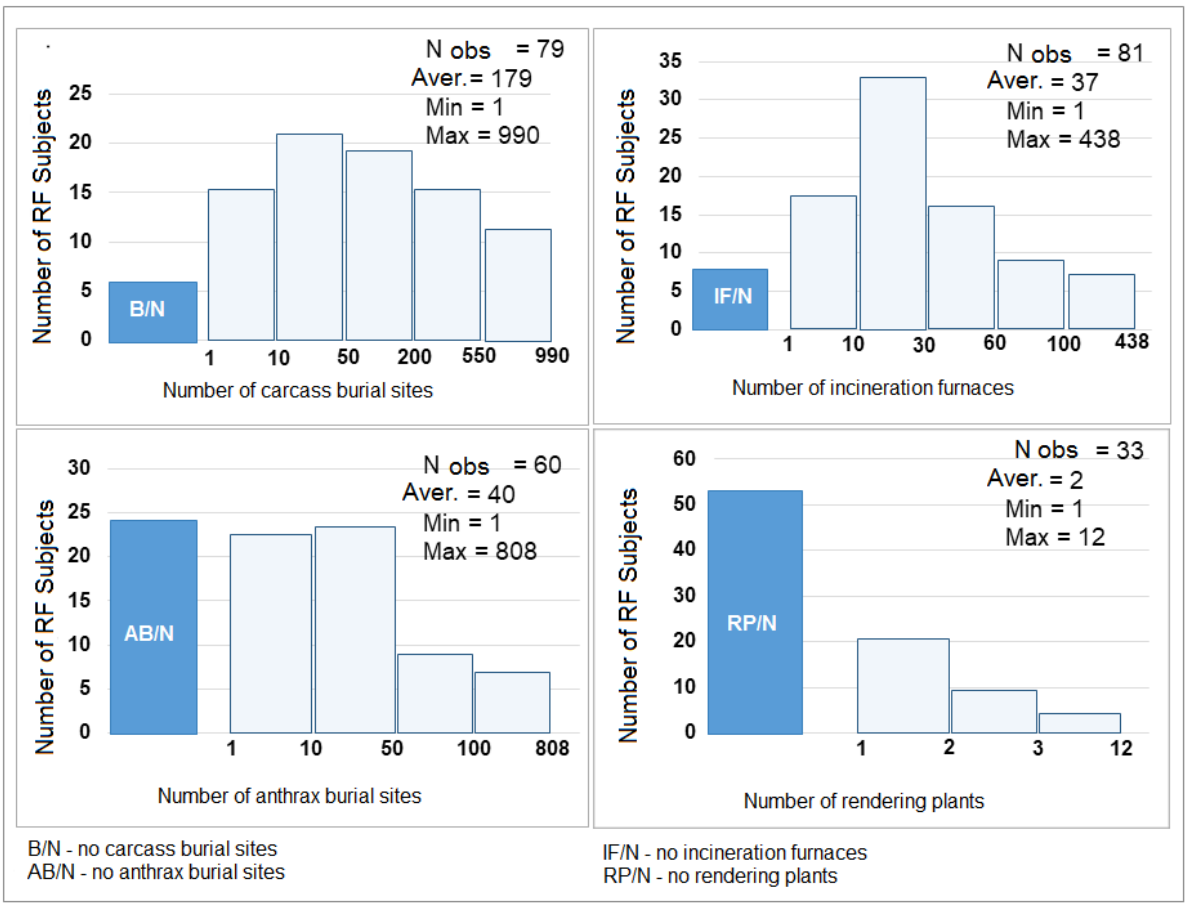


Fig. 2. Quantitative distribution of biological waste rendering and disposal facilities in the RF (as of 2018)

This number is not more than 20 for one third of these Subjects (33).

It should be noted that currently there is much concern about the ownership of carcass burial sites (including anthrax ones), because 7,970 carcass burial sites and 1,499 anthrax burial sites are orphan sites. Therefore it can be supposed with a certain degree of confidence that the abovementioned carcass burial sites are in improper veterinary and sanitary condition and there is a potential risk of different animal disease agents' escape into environment, thus creating real threats to human and animal health.

The total number of incineration furnaces in the country is 3,436 and they are located almost in all RF Subjects, except for Karachay-Cherkessia Republic, Republic of Tatarstan and Samara Oblast. The majority (40%) of incineration furnaces is within the range of 11–30 units per Subject (Fig. 2). There are regions where a significant number of furnaces is located (more than 100), that is in Leningrad (112), Vladimir (140), Moscow (141), Vologda (167) Oblasts, Republic of Udmurtia (173), Stavropol (191) and Krasnodar (438) Krais.

There are also 70 rendering plants, located in the territory of 33 RF Subjects (Fig. 2), and the majority of them is concentrated in in the Central, North-West and Far East Federal Districts, whereas there are no plants at all in the North Caucasus Federal District. The biggest number of rendering plants is located in the Sakhalin (12), Leningrad (9), Novgorod (5) and Belgorod (4) Oblasts; the rest of the RF Subjects report one plant per the Subject.

Availability of biological waste rendering and disposal facilities

The number of BWRDFs in the RF Subjects shall be determined based on the amounts of biological waste of animal origin, generated in the territory as a result of public and business operators' activities. Every type of biological waste rendering and disposal facility has a certain capacity and is destined for rendering or disposal of different categories of biological wastes. In this light, it is feasible to evaluate the availability of BWRDFs separately for each type.

The results of the analysis performed suggest that the situation with carcass burial sites is favourable in the majority of the RF Subjects, as 100% availibility is reported in 64 (75%) RF Subjects. However, there is an additional need in these sites in 21 RF Subjects and the availibility value varies from 3 to 93% (Fig. 3).

The analisys performed proved that more than a half of the RF Subjects (47) are 100% suffucient in this type of disposal facilities, and the rest 38 Subjects demonstrate availability value of 1–97%. The highest demand in incineration furnaces is revealed in Siberia Federal District (35%) and North Caucasus Federal District (68%).

According to the data obtained by the evaluation of rendering plant availability in the RF Subjects, it was revealed that there are no such plants in 53 Subjects, but they are needed only in 22 Subjects out of them (Fig. 3). The rest 32 Subjects are 100% sufficient in rendering plants, except for Amur and Sverdlovsk Oblasts and Primorsky Krai with the availability less than 50%.

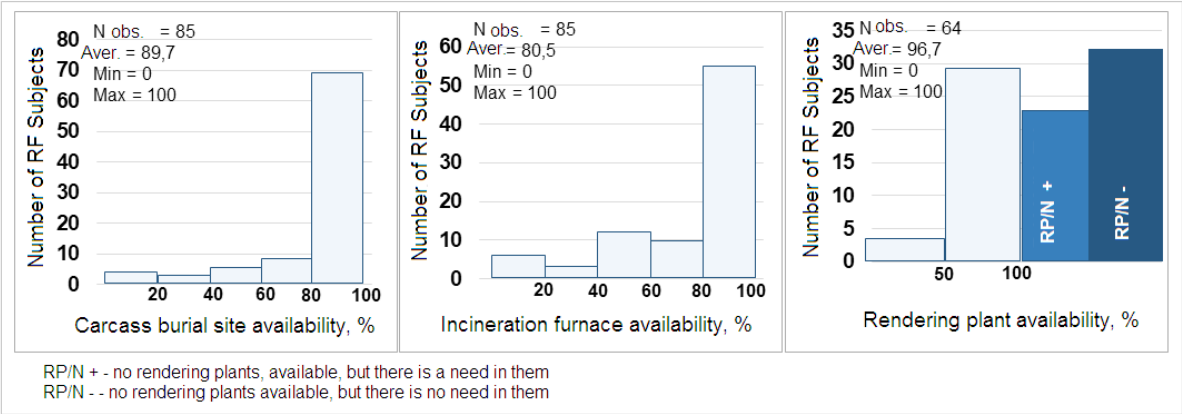


Fig. 3. Availability of biological waste rendering and disposal facilities in the RF (as of 2018)

The situation with poor availability of BWRDFs in some Subjects shall be immdeiately improved. It creates conditions for illegal burial of biological waste; this process becomes loosely regulated by the Subject Veterinary Service and ultimately hinders the stability and improvement of the epidemic situation in the territories under their responsibility.

Control of veterinary and sanitary condition of biological waste rendering and disposal facilities

At the next stage of the survey, the inspections of carcass burial sites by Veterinary Services were evaluated. The data obtained suggest that in majority of the RF Subjects all registered carcass burial sites were inspected. Exceptions were 15 RF Subjects where controls by the state veterinary services covered not all carcass burial sites with 912 of them left non-inspected. A significant number of non-inspected carcass burial sites accounts for Altay (95), Perm (199) Krais, Tambov (100), Kaluga (155) Oblasts and Republic of Dagestan (242). For the rest 10 Subjects the number of non-inspected carcass burial site is 1–23. The majority of all non-inspected carcass burial sites is operated by organizations under different forms of ownership (agricultural production cooperatives, public companies, sole proprietors, etc.) (Fig. 4).

With respect to anthrax burial sites it should be noted that 315 of them were not covered by controls in the following Subjects: Republic of Sakha (Yakutia) (237), Perm Krai (54), Lipetsk Oblast (17), Jewish Autonomous Oblast (6) and Altay Krai (1). In majority of cases not orphan anthrax burial sites were not inspected (Fig. 4).

Anyway, regardless of the number and type of the inspected carcass burial sites, it is likely that their veterinary and sanitary condition is unsatisfactory, thus creating potential threat to the epidemic situation in some territories; in particular, this is related to anthrax burial sites.

Veterinary and sanitary condition of carcass burial sites

Biological waste rendering and disposal processes pose the risk of infectious agent spread and environmental contamination. First of all it this is associated with the fact,

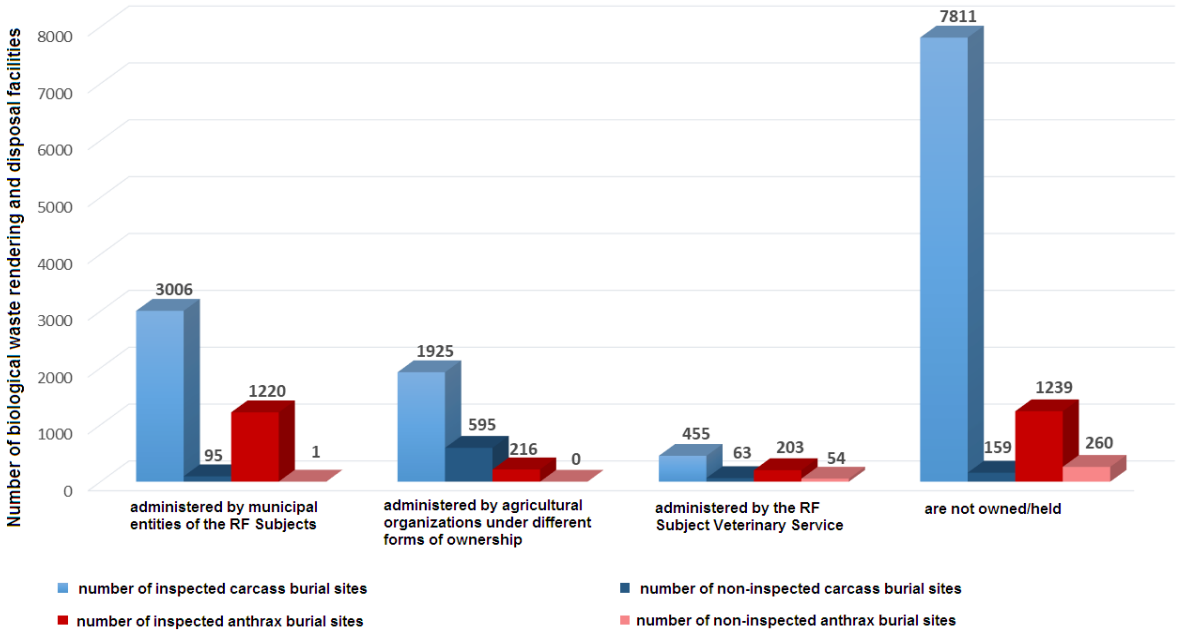
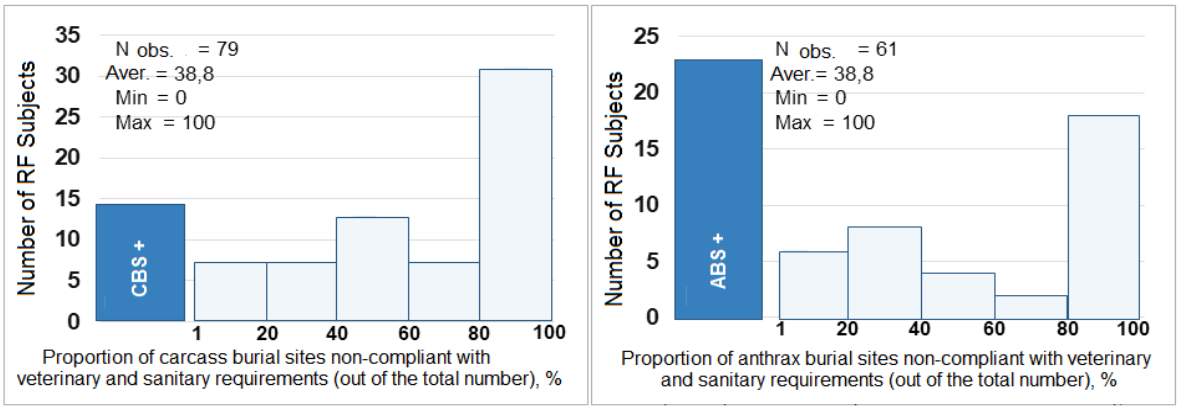


Fig. 4. Number of inspected and non-inspected carcass burial sites (including anthrax ones) (as of 2018)



CBS+ - carcass burial sites compliant with veterinary and sanitary requirements
ABS+ - anthrax burial sites compliant with veterinary and sanitary requirements

Fig. 5. Veterinary and sanitary condition of carcass burial sites (including anthrax ones) in the RF (as of 2018)

that decontamination of biological waste in the burial sites takes a rather long time. Moreover, the biggest danger is posed by the disposal sites in unsatisfactory condition.

That is why the proportion of carcass burial sites, non-compliant with veterinary and sanitary standards, was calculated. Based on the analysis results it was shown that about 60% (8,329) of carcass burial sites in the country do not comply with veterinary and sanitary requirements. They are located in 65 RF Subjects; and in half of them this proportion varies from 80 to 100% (Fig. 5). The majority (72%) of non-compliant carcass burial sites are orphan sites.

Similar patterns can be also observed for anthrax burial sites. Only in 23 regions out of 61 Subjects, where anthrax burial sites are located, all such sites are satisfactory from the sanitary point of view. For 11 RF Subjects the situation is dramatic, as all available anthrax burial sites are non-compliant. The percentage of non-compliant anthrax burial sites in the rest RF Subjects varies from 2 to 99%.

Location of carcass burial sites with regard to water bodies

The Veterinary Law stipulates veterinary and sanitary standards, which prohibit the location of carcass burial sites in water protection areas and in flooded areas. However, in some RF subjects this veterinary law requirement is not completely implemented. There 26 carcass burial sites in the country, located in the water protection areas, in the Republic of Khakassia (1), Kamchatka Krai (2), Tambov Oblast (5), Republic of Tatarstan (7) and Republic of Kabardino-Balkaria (11).

The number of anthrax burial sites, located in water protection areas is 45 and they are registered in Novgorod (1), Ivanovo (2), Kirov (2), Chelyabinsk (2), Nizhny Novgorod (5) Oblasts, Kabardino-Balkaria Republic (5) and Republic of Tatarstan (28), herewith the owner/administrator was established not for all of them (Table).

Carcass burial sites located within flooded areas are registered in the Republic of Buryatia (1), Altay Krai (3) and

Table
Number of carcass burial sites (including anthrax ones) located in the flooded and water protection areas of the RF Subjects (as for 2018)

RF Subject		Ivanovo Oblast	Tambov Oblast	Novgorod Oblast	Republic of Dagestan	Republic of Kabardino-Balkaria	Kirov Oblast	Nizhny Novgorod Oblast	Republic of Tatarstan	Republic of Mary El	Chelyabinsk Obalst	Altay Krai	Republic of Khakassia	Kamchatka Krai	Jewish AO	Republic of Buryatia	**Total in RF**
BWRDFs located in water protection areas	carcass burial sites	0	5	0	0	11	0	0	7	0	0	0	1	2	0	0	**26**
	orphan carcass burial sites	0	0	0	0	11	0	0	0	0	0	0	0	0	0	0	**11**
	anthrax burial sites	2	0	1	0	5	2	5	28	0	2	0	0	0	0	0	**45**
	orphan anthrax burial sites	2	0	1	0	1	1	0	0	0	2	0	0	0	0	0	**7**
BWRDFs located in flooded areas	carcass burial sites	0	0	0	14	0	0	0	0	0	0	3	0	0	0	1	**18**
	orphan carcass burial sites	0	0	0	0	0	0	0	0	0	0	3	0	0	0	1	**4**
	anthrax burial sites	1	0	0	0	2	0	5	0	3	0	1	0	0	1	1	**14**
	orphan anthrax burial sites	1	0	0	0	1	0	0	0	0	0	1	0	0	1	1	**5**

Republic of Dagestan (14) and their total number is 18; 4 out of them are orphan sites. Besides all carcass burial sites within this category are operational and do not comply with veterinary and sanitary rules. 15 anthrax burial sites, located in the Jewish Autonomous Oblast (1), Republic of Buryatia (1), Altay Krai (1), Ivanovo Oblast (2), Kabardino-Balkar Republic (2), Republic of Mary El (3) and Nizhny Novgorod (5), herewith one third of them is not owned/administered (Table). Several RF Subjects do not comply with veterinary and sanitary requirements related to the location of carcass burial sites close to water bodies. About one hundred of carcass burial sites (including anthrax ones) are located in water protection and flooded areas.

CONCLUSIONS

Biological waste rendering and disposal facilities are the source of environmental contamination, including contamination of surface and ground waters, they contribute to preservation of animal infectious disease nidi, thus creating real threats to human and animal health.

The most significant parameters used to describe the conditions of such facilities were selected: quantity and type distribution, form of the ownership, availability, control of veterinary and sanitary condition of carcass burial sites and their location close to water bodies, because exactly these parameters are associated with potential risks for epidemic situation in case of unfavorable scenarios.

The analysis results demonstrate that the situation with biological waste handling, rendering and disposal is tense in the Subjects of the Russian Federation. First of all this is conditioned by the fact, that more than a half of carcass burial sites (including anthrax ones) do not comply with veterinary and sanitary requirements. Moreover, the situation is even worse, as the significant part of carcass burial sites (including anthrax ones) are orphan sites. In this light, currently there is a need to improve the existing system of BWRDF condition evaluation in the RF Subjects. The system upgrade shall first cover the development of common registration forms for carcass burial sites, anthrax burial sites, incineration furnaces and rendering plants and new check lists to be used by Veterinary Services of the RF Subjects while inspecting biological waste rendering and disposal facilities.

Conflict of interest. Authors declare no conflict of interest.

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