The Federal Nuclear and Radiation Safety Authority of Russia
(Gosatomnadzor of Russia)

FEDERAL NORMS AND RULES
IN THE FIELD OF USE OF NUCLEAR ENERGY

Approved
by the decree
of Gosatomnadzor of Russia
on September 27, 2000.
№ 8

COLLECTION, TREATMENT, STORAGE AND CONDITIONING OF SOLID RADIOACTIVE WASTE. SAFETY REQUIREMENTS

NP-020-2000

Enforced
on January 1, 2001

Moscow 2000

UDK 621.039.58

COLLECTION, TREATMENT, STORAGE AND CONDITIONING OF SOLID RADIOACTIVE WASTE. SAFETY REQUIREMENTS. NP-020-2000

Gosatomnadzor of Russia
Moscow, 2000

The Federal Norms and Rules “Collection, treatment, storage and conditioning of solid radioactive waste. Safety Requirements" establishes safety requirements to collection, treatment, storage and conditioning of solid radioactive waste at nuclear installations, radioactive sources, storage facilities for nuclear materials and radioactive substances, storage/disposal facilities for radioactive waste (RW).

The regulatory document is published for the first time.

The regulatory document is prepared by the Scientific and Engineering Center for Nuclear and Radiation Safety (SEC NRS) with the participation of Zaharova K.P, Masanov O.L. (A.Bochvara VNIINM), Kiselev V.V. (Minzdrav of Russia), Margulis U.I. ("Institute of Biophysics"), Nepeipivo M.A., Charafoundinov R.B. (SEC NRS).

The experts from the following organizations contributed to drafting and review of the document:

Minzdrav of Russia, Goskomecology of Russia, Minatom of Russia, A.A.Bochvara VNIINM, MosNPO “Radon”, VNIPIET, Institute of Biophysics, Mining Chemical Plant, Siberian Chemical Combine, PO “Mayak”, Rosenergoatom ”, Leningrad NPP etc.

CONTENT

Acronyms and Abbreviations

RW – radioactive waste**SRW –**solid radioactive waste**AS** – alarm system

SSCR -self-sustaining chain reaction

1. DEFINITIONS

1. Water resistance – the ability of a package to keep its properties and to confine radionuclides during water contact.

2. Science and technology state-of-the-art - part of science and engineering knowledge, technological and design developments in the specific field of science and engineering, which has been proved by research studies and practical experience and reported in scientific and technical documents.

3. Sealed radionuclide source - entity containing radioactive materials and designed to prevent interaction of radioactive materials with the environment and maintain radionuclide contamination of the environment within regulatory limits, provided it is used according to the conditions anticipated for its use.

4. SRW conditioningoperations that produce waste packages suitable for safe storage and/or transportation and/or disposal. Conditioning may include the conversion of the SRW to a stable form, enclosure of the SRW in containers.

5. RW container – the vessel used for collection and/or transportation, and/or storage, and/or disposal of RW.

6. Corrective actions – the actions taken to eliminate nonconformities and prevent their reoccurrence.

7. SRW management –all activities that are related to collection, transport, treatment, conditioning, storage and/or disposal of the SRW.

8. Quality assurance of RW management (hereinafter - quality assurance**)** – planned and systematic activity necessary to ensure that all RW management activities having an effect upon nuclear and radiation safety are performed in compliance with the federal norms and rules in the field of nuclear energy use and with other regulatory documents, and that the results satisfy to requirements.

9. Waste, radioactive – the materials in any forms, products, apparatus, equipment, biological items for which no use is anticipated in the future and that contain radionuclides at concentrations exceeding levels set by the federal norms and rules in the field of use of nuclear energy. Categorization of mentioned substances, materials, products, apparatus, equipment, biological items as RW is decided by the operating organization and it has to be justified in the design of the facility.

10. Waste, solid radioactive mixed – the SRW containing toxic and pathogenic materialsядовитые,, biologically active materials, putrescent and decomposed materials, strongly oxidizing agents, corrosive and chemically unstable materials.

11. SRW treatment - комплекс технологических процессов, направленных на уменьшение объема образовавшихсяoperations intended to change the form of the SWR and to reduce its volume.

12. Quality assurance program - well-documented set of administrative and technical measures and other measures related to quality assurance which allow management of operating organization and/or organizations carrying out works and providing services for operating organizations, to make sure that all activities having an effect upon nuclear and radiation safety are performed in accordance with the federal norms and rules in the field of use of nuclear energy and other regulatory documents.

13. SRW collection – accumulation of SWR in primary packages at specially designed and engineered places.

Note.

Polyethylene bags, crafts - bags, wooden and plywood boxes, metal and other enclosures preventing release of radioactivity can be used as containers for primary packages.

14. RW package –packaging assembly (container) containing RW and the RW itself that intended for transportation, and/or storage, and/or disposal.

15. RW storage – interim placement of SRW in vessels (storage facilities) where radiation protection and isolation of SRW are provided with the intention of retrieving the SRW.12. Контейнер малой грузоподъемности (КМГ) (английское сокращение IBC) - жесткий, полужесткий или мягкий упаковочный комплект,который:

6. Грузовой контейнер - единица транспортного оборудования многократного применения, предназначенная для перевозки и временного хранения грузов без промежуточных перегрузок, удобная для механизированной загрузки и разгрузки, погрузки и выгрузки, внутренним объемом, равным 1 м3 и более. К малым грузовым контейнерам относятся грузовые контейнеры, у которых один из габаритных размеров не более 1,5 м или внутренний объем не более 3 м3. Любой другой грузовой контейнер считается большим грузовым контейнером. Грузовой контейнер может использоваться для выполнения функций транспортного пакета.

Примечание. Термин не включает понятие тара, упаковка, транспортное средство.

Грузовые контейнеры подразделяются на универсальные и специализированные.

6.1. Универсальный контейнер - грузовой контейнер для штучных грузов широкой номенклатуры, укрупненных грузовых единиц и мелкоштучных грузов.

6.2. Специализированный контейнер - грузовой контейнер для грузов ограниченной номенклатуры или грузов отдельных видов. Среди специализированных контейнеров различают групповые (для группы однородных грузов), изотермические, индивидуальные (для отдельных видов грузов), контейнеры-цистерны (для жидких грузов, газов или сыпучих грузов) и другие.

41. Транспортирование (перевозка) - перемещение груза от грузоотправителя до грузополучателя, включая транзитное хранение, погрузку и выгрузку в пути.

46. Транспортный упаковочный комплект (упаковочный комплект) - совокупность компонентов, необходимых для размещения и удержания радиоактивного содержимого.

Упаковочный комплект может, в частности, содержать одну или несколько емкостей, сорбирующие вещества, дистанционирующие конструкции, устройства для защиты от излучений, для охлаждения и тепловой изоляции, амортизаторы. Упаковочный комплект может быть в виде ящика, коробки, бочки или аналогичных емкостей, или может представлять собой грузовой контейнер, резервуар или контейнер малой грузоподъемности (КМГ).

28. Радиационная упаковка (упаковка) - транспортный упаковочный комплект с находящимся в нем радиоактивным содержимым, подготовленный для перевозки.

47. Удельная активность (изотопа, материала) - активность единицы массы данного изотопа (материала). Для материала активность должна быть достаточно равномерно распределена по объему.

48. Упрощенная (освобожденная) упаковка - упаковочный комплект простой конструкции, содержащий настолько малое количество радиоактивного материала, что при ее транспортировании должны выполняться минимальные требования безопасности.

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28. Радиационная упаковка (упаковка) - транспортный упаковочный комплект с находящимся в нем радиоактивным содержимым, подготовленный для перевозки.

2. Objective and application

2.1. The present document establishes safety requirements for collection, treatment, storage and conditioning of SRW at nuclear installations, radioactive sources, facilities for storage of nuclear materials and radioactive substances, facilities for storage/disposal of radioactive waste (hereinafter - storage/disposal facilities).

2.2. The document applies to nuclear installations, radioactive sources, storage/disposal facilities which are being designed, constructed, operated or decommissioned in the framework of SRW collection, treatment, conditioning, storage and disposal activities.

2.3. The present document do not apply to:

- spent nuclear fuel management;
- management of SWR resulting from mining and millingруд of radioactive ores and other mineral resourcesвеществ;
- management of SWR resulting from remediation of areas contaminated with radioactivity.

3. General safety requirements for collection, treatment, storage and conditioning of solid radioactive waste

3.1. Technical means and organizational measures to provide radiation safety during collection, treatment, conditioning, storage and disposal of SRW at nuclear installations, radioactive sources, storage facilities shall be established on the basis of maximum allowable SRW activity in these facilities and shall keep radiological impact on workers (personal), the general public and the environment within limits established by the Safety Radiation Norms (NRB-99), federal norms and rules in the field of use of nuclear energy and other normative documents.

3.2. Specific technical measures for safe collection, treatment, conditioning, storage and disposal of SRW developed in accordance with the requirements of the present document, the federal norms and rules in the field of use of nuclear energy and other regulatory document, must be provided by the design of nuclear installations, radioactive sources, storage/disposal facilities.

If such regulatory documents are not available, planned technical measures have to be specified and justified in the design of nuclear installations, radioactive sources, storage/disposal facilities in accordance with state-of-the-art science and technology.

3.3. Requirements related to design, manufacturing and assembling of the equipment used for collection, treatment and conditioning of SRW and design of relevant systems (components) of nuclear installations, radioactive sources, storage/disposal facilities, as well as classification of the systems (components) and equipment used for collection, treatment, storage and conditioning depending on their purpose, their safety importance, their safety function and their seismic, fire and explosive categories are set by the federal norms and rules in the field of use of nuclear energy related to regulation of the safety of nuclear installations, radioactive sources, storage/disposal facilities, and the present document.

3.5.4 Design and reliability of systems (components) of nuclear installations, radioactive sources, storage/disposal facilities, documentation and operations associated to collection, treatment and conditioning of SRW are subject to quality assurance according to the quality assurance program developed by operating organizations and/or organizations carrying out works and providing services for operating organizations and shall meet the federal norms and rules in the field of use of nuclear energy and other regulatory documents.

3.4.1 Quality assurance program is aimed at providing:

- effective training, re-training and qualification for the workers (personal);
- minimization of generated SRW with regard to its activity and quantity;
- quality control of purchased equipment, components and materials;
- adequate and detailed information on quantitative and quality inventory of SRW at the places where it is generated, collected, treated, stored and conditioned;
- quality control of operations related to collection, treatment, storage and conditioning of SRW;
- organization of the SRW quality criteria system that collected, treated, stored and conditioned SRW shall meet after collection, treatment, storage and conditioning;
- utilization of metrological testing and certifying techniques for quality control of the SRW and packages containing conditioned waste;
- organization of quality control of the SRW and packages containing conditioned waste;
- organization of the system related to documentation and data recording during collection, treatment, storage and conditioning of SRW, including identification and labeling of RW packages.

3.4.2. While establishing SRW quality criteria the main characteristics of the SRW, container and packages of SRW have to be considered depending on the SRW management stage.

3.4.2.1. Characteristics of SRW:

- origin, physical form and chemical content;
- total activity;
- radionuclide content, specific α- and β-activity, equivalent dose rate.

3.4.2.2. Characteristics of SRW container:

- corrosion resistance, radiation resistance, configuration (geometrical dimensions) - for a metallic container;
- density, porosity, water permeability, gas permeability, frost resistance, radiation stability, stability (resistance) to microorganisms, mold and fungi, fire resistance, configuration (geometrical dimensions) - for a reinforced concrete container;
- other characteristics relevant to confining performance of the container.

3.4.2.3. Characteristics of SRW package:

- radionuclide content, specific α- and β-activity, equivalent dose rate;
- total activity;
- homogeneity (lack of cavities);
- mechanical strength (static, dynamic, impulsive loads), thermal stability and thermal cycle stability, radiation resistance - for packages intended for disposal.

3.4.3. The SRW and conditioned waste quality control system shall include quality control related to:

- SRW collection process;
- SRW intended to treatment;
- SRW treatment process;
- matrix materials;
- conditioned waste packages.

Content of quality control is specified in the design of nuclear installations, radioactive sources, storage/disposal facilities and shall be such that it allows acquiring reliable information on the performances of the SRW, matrix materials and conditioned waste packages.

3.4.4. The quality assurance program shall define the order and procedures of recording of nonconformities (failures, malfunctions, deficiencies, deviations) of SRW and conditioned waste with regard to quality criteria as well as procedures related to data collection, data processing and analysis of information concerning the investigations of the nonconformities cases.

As a result of these investigations, corrective actions shall be identified and taken to preclude the repetition of the occurrence.

3.4.5. The operating organization must control how the quality assurance program is implemented at nuclear installations, radioactive sources, storage/disposal facilities by means of audits (inspections) which deal with the following:

- verification of compliance of SRW collection, treatment, conditioning and storage processes with operating parameters according to requirements of the federal norms and rules in the field of use of nuclear energy and the conditions stated in the license issued by the State safety regulatory authority in the field of use of nuclear energy;
- checking of operational availability of control systems;
- checking compliance of quality of SRW and conditioned waste packages with the quality criteria.

If during the checks (inspections) some nonconformities would be revealed, appropriate corrective measures should be taken in all cases of nonconformities.

3.6. It shall be ensured during collecting, treating, storing and conditioning of SRW that:

- safety level during management of SRW as well as ionizing radiation sources is kept as required;
- unacceptable exposure of the workers (personal) is excluded;
- exposure of the workers (personal) and the population is minimized to a reasonably practicable level with regard to sanitary regulations, norms and hygienic specifications, economical and social factors;
- occurrence of potential accidents which may lead to radiological consequences are prevented and the consequences of accidents are mitigated, should they occur;
- reduction of SRW volume;
- preparation of SRW for disposal.

3.6. The classification of rooms for collection, treatment, storage and conditioning of SRW, depending on associated fire and explosive hazards, shall be specified in the design of nuclear installations, radioactive sources, storage/disposal facilities in accordance with requirements of the federal norms and rules in the field of use of nuclear energy.

Specific technical and administrative measures necessary to provide fire and explosion safety during collection, treatment, storage and conditioning of SRW have to be specified and justified in the design of nuclear installations, radioactive sources, storage/disposal facilities.

3.7. The rooms designed for SRW treatment, storage and conditioning shall be equipped with ventilation systems to prevent rooms and the environment to be contaminated with radioactivity and to provide normal climatic conditions required for normal equipment operation.

If dust may arise during SRW treatment, provisions shall be made to prevent dust release into working rooms and/or the environment.

Contaminated air removed from the rooms and off -gas shall be treated prior to discharging to the atmosphere.

3.8. During collection, treatment, storage and conditioning of SRW the following arrangements shall be provided:

- technical and administrative measures to ensure physical protection of SRW;
- radiation control including: monitoring of surface contamination of rooms, equipment and pipelines, equivalent dose rate measuring, SRW specific activity and radioactive content.

Means and extent of the radiation control are specified in the design of nuclear installations, radioactive sources, storage/disposal facilities in accordance with requirements of sanitary regulations, norms and hygienic specifications, the federal norms and rules in the field of use of nuclear energy.

трических источников инициирования взрыва;

применение систем аварийной защиты и сигнализации по превышению установленных уровней концентрации взрывоопасных сред;

защита оборудования и помещений от разрушения при взрыве при помощи устройств аварийного сброса давления;

применение огнепреградителей, гидрозатворов, инертных (не поддерживающих горение) газовых или паровых завес;

применение систем активного подавления взрыва с участием средств предупредительной сигнализации.

использование инертных газов при технологических операция с самовоспламеняющимися материалами

использование кабелей в пожаростойком исполнении в системах, при эксплуатации которых возможны возгорания и пожары;

использование методов и средств по обнаружению и предотвращению образования взрывоопасных концентраций газов в оборудовании и помещениях.

Конкретные технические решения и организационные мероприятия по обеспечению взрывозащиты и противопожарной защиты при сборе, переработке, хранении и кондиционировании ТРО устанавливаются и обосновываются в проекте ядерной установки, радиационного источника и пункта хранения.

ировать взрыв взрывоопасной среды;

применение средств защиты от статического электричества, блуждающих токов, токов замыкания на землю;

применение взрыво- пожарозащищенного электрооборудования;

применение быстродействующих средств защитного отключения возможных электрических источников инициирования взрыва;

применение систем аварийной защиты и сигнализации по превышению установленных уровней концентрации взрывоопасных сред;

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3.9. During collection, treatment, storage and conditioning of SRW containing nuclear fissile materials the possibility of occurrence of a criticality accident shall be prevented.

The design and geometrical configuration of the equipment used for collection, treatment, storage and conditioning of SRW containing nuclear fissile materials as well as operational procedures shall prevent criticality occurrence.

The content of nuclear fissile materials in conditioned SRW and geometrical configuration of the packages shall be such as it eliminates any possibility of criticality accident.

Areas where equipment used for collection, treatment, storage and conditioning of SRW containing nuclear fissile materials is located shall be equipped with automated control system which shall be operated on a permanent basis to detect criticality excursion.

Criticality safety during collection, treatment, storage and conditioning of SRW containing nuclear fissile materials is regulated by the federal norms and rules in the field of use of nuclear energy related to nuclear safety.

3.10. During collection, treatment, storage and conditioning of SRW, possibility of decontamination of equipment, pipelines, casks/containers and rooms shall be ensured. Surfaces of equipment and rooms used for

collection, treatment, storage and conditioning of SRW shall be adequately corrosion-resistant to aggressive conditions, have low sorbing capacity with respect to radioactive substances and be easily decontaminated.

3.11. Collection, treatment, storage and conditioning of SRW together with non-radioactive waste is forbidden.

3.12. Collection, treatment, storage and conditioning of SRW shall be well documented in accordance with the quality assurance program. At each stage of management of SRW packages, documents containing basic information on the packages shall be attached to them, including:

3.12.1. For SRW collection stage:

- originating source;
- inventory;
- physical nature and chemical content;
- total activity;
- radionuclide content, specific α- and β-activity, date of the activity measurements;
- type of container (for SRW package);
- date of packaging (for SRW package);
- equivalent dose rate (for SRW package);
- surface contamination of the container (for SRW package);
- package identification (for SRW package);
- identification of storage location;
- compliance with quality criteria.

3.12.2. For SRW treatment stage:

- originating source;
- treatment technologies;
- inventory;
- physical nature;
- chemical content;
- total activity;
- radionuclide content, specific α- and β-activity, date of the activity measurements ;
- type of container (for SRW package);
- date of packaging (for SRW package);
- equivalent dose rate (for SRW package);
- surface contamination of the container (for SRW package);
- package identification (for SRW package);
- identification of storage location;

3.12.3. For SRW conditioning stage:

- originating source;
- inventory;
- treatment technologies;
- conditioning technologies;
- total activity;
- radionuclide content, specific α- and β-activity, date of the activity measurements;
- type and identification of container (for SRW package);
- date of packaging (for SRW package);
- surface contamination of the container, equivalent dose rate of the package, date of the activity measurements;
- package identification;
- identification of storage location.

For sealed radionuclide sources the following data are indicated: manufacturing identification number, production date, certificate number, type of radiation; activity at the date of production, equivalent dose rate, date of its withdrawal.

4. SAFETY REQUIREMENTS FOR COLLECTION OF SOLID RADIOACTIVE WASTE

4.1. Collection of SRW is a compulsory preparation stage to waste treatment, storage and conditioning and shall be performed in such a way to ensure that release of radionuclides to the environment is within the limits set by sanitary regulations, norms and hygienic specifications, federal norms and rules in the field of use of nuclear energy by accumulation of the SRW in specified equipment.

4.2.During its collection stage, SRW shall be segregated according to its specific activity and radionuclide content (including alpha- radionuclides), physical nature and with consideration of the anticipated method of waste treatment.

Depending on waste treatment method, the SRW falls into the following categories: compactable, burnable, fragmentable, easily melted and non-treatable waste.

4.3. Collection of SRW shall be performed with respect of the requirements listed in the chapter 4.2 of the present document, in order to ensure a reasonable minimization of radiation exposure of the workers (personal). The sequence of operations related to collection of SRW is specified and justified in the design of nuclear installations, radioactive sources, storage/disposal facilities.

4.4. SRW shall be collected at specially designed and appropriately equipped places. The collection areas and containers for SRW shall be located as close as possible of a place of waste generation.

4.5. Explosive and flammable SRW shall be separately collected.

4.6. SRW containing only radionuclides with half-life lower than 15 days shall be separately collected and temporarily stored to allow their specific and total activity to decrease to a level at or below which radioactive materials are exempted from regulation, according to the Basic sanitary rules for radiation protection (OSPORB-99).

4.7. SRW shall be collected while using containers identified by labeling. 4.8. The surfaces of high sized metallic SRW not open to treatment shall be decontaminated and covered with a protective layer to prevent dispersal of radionuclides into the environment.

4.9. The metallic SRW subjected to melting shall be collected separately from other SRW.

4.9.0Metallic SRW of low level specific activity and surface contamination shall, if necessary, be decontaminatedAfter decontamination, the SRW are subjected to radiation control and then, depending on the results of the control, they can be either transferred to further treatment, storage and/or disposal or exempted from RW categoryThe requirements concerning means and methods of decontamination of the metallic SRW and radiation control of SRW are established by the regulatory documents.4.10.1Spent sealed radionuclide sources shall be collected separately from other SRW in places especially intended for this purpose. Spent sealed radionuclide sources shall be collected in transportation packing casks such as KTB and etc.

КАК РАЗДЕЛИТЬ ПРИ СБОРЕ:

ОТХОДЫ МЕДИЦИНЫ И ОТХОДЫ АС ИЛИ ПТЦ

4.6. При сборе ТРО должны использоваться специальная унифицированная тара и транспортные контейнеры. Тара и контейнеры должны иметь унифицированную идентификационную маркировку и должны быть снабжены надписями, характеризующими2 SRW subjected to incineration and/or compacting can be packaged into multi-layer paper or polyethylene bags and shall be placed into containers, which provide radiation protection of the workers (personal).***ТРО.***

5. Safety requirements for treatment and conditioning of solid radioactive waste

5.1. Treatment and conditioning of SRW shall provide a reduction of its volume and conversion of the waste to a form suitable for safe transportation and/or storage and/or disposal

5.2. Treatment of SRW may be performed by incineration, compaction, crushing/grinding (fragmentation), melting (for metal waste). Other SRW treatment methods may be used if they are developed in accordance with state-of-the-art science and technology. Specific methods and technologies for SRW treatment are specified and justified in the design of nuclear installations, radioactive sources, storage/disposal facilities.

5.3. To reduce the volume of combustible SRW and eliminate fire risk during its storage, transportation and disposal, this waste shall be incinerated.

5.3.1. The following means shall be provided for incineration of the SRW:

- cleaning up system for off gas generated by incineration of the SRW in order to reduce radioactive contamination and chemical toxic content to levels set by the Safety Radiation Norms (NRB-99) and the federal norms and rules in the field of use of nuclear energy;
- monitoring of incineration process parameters including: температураemperatures and pressures (reduced pressure) in the incineration furnace, contents of explosion-hazardous components, radionuclide content of off-gas streamsсопротивление;
- automated and/or remote control of the incineration process;
- decontamination of equipment and rooms;
- fire-alarm and fire-fighting systems.

5.3.2. ПараметрыThe process operating conditions for incineration of SRW shall lead to a complete oxidization of intermediate combustion and pyrolysis products.

5.3.3. SRW transferred to incineration shall be subjected to an acceptation test control. The SRW containing explosion-hazardous materials must not be incinerated. The content of polyvinylchloride and other materials which can generate, as a result of incineration, aggressive and toxic substances in quantities exceeding

levels set by regulatory documents shall be limited in the SRW to be incineratedContent of the radionuclides: ^{14}^{129}and ^{3}in incinerated SRWshall not exceed acceptable level for discharge of radioactive substances from incineration furnace to the atmosphere.Incineration of SRW together with non-radioactive waste is prohibited.

5.3.4.5.3.6. The ashes arising from SRW incineration shall be converted to an immobilized monolithic form.

5.4. To reduce the volume, noncombustible SRW should be compacted.

5.4.1 The technical means implemented for compaction of SRW shall be provided in order to:

- prevent dispersal of dust and radioactive aerosols to the atmosphere;
- remove and collect water moisture exuded from compacted SRW;
- pack compacted waste into containers;
- enable automated and/or remote control of the process.

5.4.2. SRW subjected to compaction shall undergo inspection tests.

SRW containing the following substances must not be compacted:

- percentage of moisture higher than 1% of waste weight;
- pyrophoric and explosive materials at a concentration that may cause an explosion of the materials when being compressed;
- nuclear fissile materials in an amount that сжатие которых may result in criticality occurrence when being compressed.

The compaction of SRW together with non-radioactive waste is forbidden.

5.5. To reduce the volume, non combustible and non compactable SRW should be fragmented by chipping or cuttingнесжигае.

During fragmentation of SRW, measures for cleaning air in the operation area from radioactive dust and aerosols shall be provided, precluding transfer of radioactive materials to working rooms and the environment in such an amount that could lead to exposure exceeding dose limits set byприводящих sanitary regulations, norms and hygienic specifications, federal norms and rules in the field of use of nuclear energy.

To reduce the volume, metallic SRW shall be decontaminated.

5.6. To reduce the volume of metallic SRW and to partially or completely decontaminate the metallic SRW by removing radionuclides in slag, the SWR shall be melted.

5.6.1. The following technical methods shall be implemented during melting of SRW:

- radiation control of SRW, including:
  - surface contamination;
  - equivalent dose rate;
  - specific activity;
  - radionuclide content;
  - automated and/or remote process control;
- control, including the following parameters:
  - temperature in furnace;
  - contents of radionuclides in off gas streams after decontamination;
  - differential pressure in the off- gas treatment system filters;
  - decontamination of equipment and working rooms;
  - fire – alarm and fire-fighting systems.

5.6.2. The SRW transferred to the melting unit shall be cleaned up from organic coatings and inorganic materials as carefully as possible.

5.6.3. The SRW transferred to the melting unit, if necessary, shall be crushed (fragmented) up to the sizes that allow feeding of the melting furnace. For fragmenting metallic SRW, the methods such as mechanical cutting, thermal cutting (gas-flame, plasma arc cutting etc.) shall be used as well as other methods, which provide a minimum level of radioactive contamination of surfaces and air of working rooms.

5.6.4. During melting of SRW, off- gas streams shall be decontaminated from radionuclides to levels set by sanitary regulations, norms and hygienic specifications, federal norms and rules in the field of use of nuclear energy as well as from toxic hazardous materials whose discharge to the environment is limited.

5.6.5. Secondary waste generated from melting of metal SRW (slag, spent components of the furnace, spent filters of off-gas treatment systems etc.) are subjected to collection, storage, treatment and conditioning in accordance with requirements of the present document.

5.7. The SRW conditioning shall provide a conversion of SRW to forms suitable for subsequent transportation and/or storage and/or disposal.

5.8. Depending on the characteristics of SRW and options for the subsequent management of conditioned SRW, including its transportation and/or treatment and/or storage and/or disposal, the conditioning of SRW should include one of the following operations or their combination:

- enclosing SRW into containers;
- enclosing and embedding SRW in container;
- overpacking of SRW container.

5.9. The methods and means for SRW conditioning used in accordance with the requirements of the present documents and other federal norms and rules in the field of use of nuclear energy shall be justified in the design of nuclear installations, radioactive sources, storage/disposal facilities.

5.10. When planning methods and means of conditioning of SRW, the following aspects shall be taken into account:

- characteristics of SRW subjected to conditioning;
- methods of the subsequent management of the conditioned SRW including treatment and/or transportation and/or storage and/or disposal;
- quality criteria established for the subsequent management stages.

5.11. Radionuclide content, specific activity, total activity in RW package, equivalent dose rate at the surface of container, contamination of external surface of the container shall meet the SRW quality criteria accepted for subsequent management stages. The waste package shall prevent unacceptable dispersion of radionuclides to the environment.

The quality performances of packages of embedded SRW shall be the same as for solidified liquid radioactive waste as it is established in the document “Collection, treatment, storage and conditioning of liquid radioactive waste. Safety requirements”.

5.12. The package of conditioned SRW shall not contain:

- strongly oxidizing agents and chemically unstable materials;
- corrosive substances;
- toxic, pathogenic and infectious materials;
- biologically active materials;
- pyrophoric, explosive and fire- hazardous materials;
- materials that can detonate or decompose by explosion ;
- materials that can react exothermally and explode with water;
- materials containing or capable to generate toxic gases, vapors or sublimates.

The percentage of liquid in packaged waste shall not exceed 3 %.

5.13. The choice of the design of the container and the choice of its structural materials shall be based on:

- physical and chemical performances(characteristics) of SRW;
- options for the subsequent waste package management;
- quality criteria established for the subsequent waste management stages.

5.14. The design of the container and structural materials of the container shall ensure its integrity and efficiency, including structural strength characteristics, during a subsequent waste package management stage.

5.15. The structural materials of the container and materials used for coating of surfaces shall ensure protection against weather impact and provide possibility of decontamination.

5.16. If method, place and specific schedule of disposal of conditioned SRW couldn’t be specified in the design of nuclear installations, radioactive sources, storage/disposal facilities, the container shall keep its integrity during all anticipated period of storage prior to disposal and shall prevent unacceptable release of radionuclides from the package. The container shall ensure a possibility of:

- retrieving of waste package from storage facility at the end of storage period;
- overpacking;
- transportation of waste package for disposal;
- package handling during disposal operations.

5.17. If waste package does not meet waste quality criteria established for transportation and/or storage and/or disposal, then additional overpacking shall be used to exclude nonconformities.

5.18. The waste containers and packages intended for long-term storage and/or disposal have to be licensed.

5.19. The storage of conditioned SRW shall be performed in specially equipped facilities with a system of barriers preventing release of radionuclides to the environment in amount exceeding levels set by sanitary regulations, norms and hygienic specifications, federal norms and rules in the field of use of nuclear energy. Technical characteristics of barriers, storage periods of conditioned SRW and number of barriers shall be specified and justified in the design of nuclear installations, radioactive sources, storage/disposal facilities in accordance with the requirements of the present documents and federal norms and rules in the field of use of nuclear energy.

6. Safety requirements for storage of solid radioactive waste

6.1. During SWR storage, it shall be ensured that SRW are stored in a way excluding:

- unacceptable exposure of workers (personal);
- unacceptable exposure of the public;

- release of radionuclides to the environment in amount exceeding levels set by sanitary regulations, norms and hygienic specifications, federal norms and rules in the field of use of nuclear energy.

6.2. Engineering and organizational measures for safe SRW storage shall be anticipated in the design of nuclear installations, radioactive sources, storage/disposal facilities and acceptable volume of SRW, radionuclide content, activity level and storage period shall be established and justified as well.

The admissible storage period of spent sealed radionuclide sources shall be defined on the base of the state of their cladding, the time during which the matrix material keeps its safety-related properties, the storage type and the time during which the barriers keep their containment properties.

6.3. Large bulks of SRW shall be stored in specially equipped facilities or in specially created sites with a system of barriers preventing release of radionuclides to the environment in amount exceeding levels set by sanitary regulations, norms and hygienic specifications, federal norms and rules in the field of use of nuclear energy. Requirements related to the barriers preventing release of ionizing radiation and radioactive substances to the environment are set by the federal norms and rules in the field of use of nuclear energy. Required performances of the barriers are specified and justified in the design of nuclear installations, radioactive sources, storage/disposal facilities in accordance with the requirements of the present document and other federal norms and rules in the field of use of nuclear energy.

6.3.1. The design and the structural materials of the storage unit shall:

- prevent release of radionuclides into the environment in an amount exceeding the levels set by sanitary regulations, norms and hygienic specifications, federal norms and rules in the field of use of nuclear energy;
- ensure a life time of the storage facility not lower than the life time of nuclear installations, radioactive sources, storage/disposal facilities.

6.3.2. Technical means shall be provided at SRW storage in order to:

- decontaminate internal storage facility surfaces;
- inspect, audit and retrieve SRW from the storage facility;
- enable remote control during transfer of SRW containers in the case of high equivalent dose rates;
- collect and remove humidity from the storage unit;
- provide fire -alarm and fire- extinguishing systems (in case of combustible SRW);
- provide ventilation;
- provide radiation monitoring.

6.3.3. Additionally, for those storage facilities where level activity is high, the following provisions shall be made:

- control of air temperature in the storage facility;
- control of hydrogen concentration in air in the storage facility;
- control of the radionuclides concentration in air of the storage facility;
- cooling of SRW placed in the storage facility.

6.3.4. Observational boreholes for sampling of groundwater shall be provided around SRW storage facilities. The number and the location of the observational boreholes are established and justified in the design of nuclear installations, radioactive sources, storage/disposal facilities.

6.4. The storage of small amount of SRW shall be carried out in specially equipped rooms. Location and equipment of the storage rooms for small amount of SRW and the conditions of its storage shall be in compliance with the requirements of the Basic sanitary rules for radiation protection (OSPORB-99) and other federal norms and rules in the field of use of nuclear energy.