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Hazardous waste management in Russia and the EU

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ESTABLISHING A NATIONWIDE MANAGEMENT FRAMEWORK FOR CLASS I AND II HAZARDOUS WASTE. ANALYSIS OF THE CURRENT SITUATION

I. I. Outline of the Federal Project *Creation of Infrastructure for Safe Handling of Class I and II Hazardous Waste*

Year 2018 saw first steps in development of a nationwide management framework for Class I and II hazardous waste. The responsibility for its disposal was suggested by the Russian Ministry of Natural Resources and Environment to be transferred to State Corporation Rosatom. The Ministry of Nature prepared a project for amendments into the Federal Law on State Nuclear Energy Corporation Rosatom and the Federal Law on Industrial and Consumer Waste.¹ The initial version of this law was reviewed on the federal portal for normative legal acts.²

The nationwide management framework for Class I and II hazardous waste has its project office located within the Federal State Unitary Enterprise RosRAO, part of State Corporation Rosatom.

Is still to be seen how the proposed changes will affect Russian waste handling practices in general, the waste market, and wellbeing of all Russians. But some problems to be faced by the future national operator are already clear. The Ministry of Nature has pointed out two of them.³ First is shortage of facilities for deactivation, disposal and storage of Class I and II waste. Second is lack of reliable data on the amounts of Class I and II waste being produced.

Some ways to resolve the shortage of processing, deactivation and disposal facilities are outlined in the Passport of the federal project *Creation of Infrastructure for Safe Handling of Class I and II Hazardous Waste*. This document can be found on websites of some regional authorities, e.g. on the website of the Economic Development Ministry of Chelyabinsk Oblast.⁴ The project has not yet been presented to the general public. Its passport is a restricted document; it constitutes an annex to the record of proceedings of the Project Committee for General Strategic Development of the Russian Federation. A brief presentation of the federal project *Creation of Infrastructure for Safe Handling of Class I-II Hazardous Waste* is available, for example, on the website for Urals Federal District.⁵

Obviously, these documents are still under development. However, we can already get a general idea of the future reform.

According to the project outline, the federal project *Creation of Infrastructure for Class I-II Hazardous Waste Handling* proposes construction of 7 industrial engineering complexes with a capacity of 50,000 tons each. Of these complexes, 4 will be converted from chemical

¹ See: <http://regulation.gov.ru/projects#npa=78522>; law draft ID: 02/04/02-18/00078522.

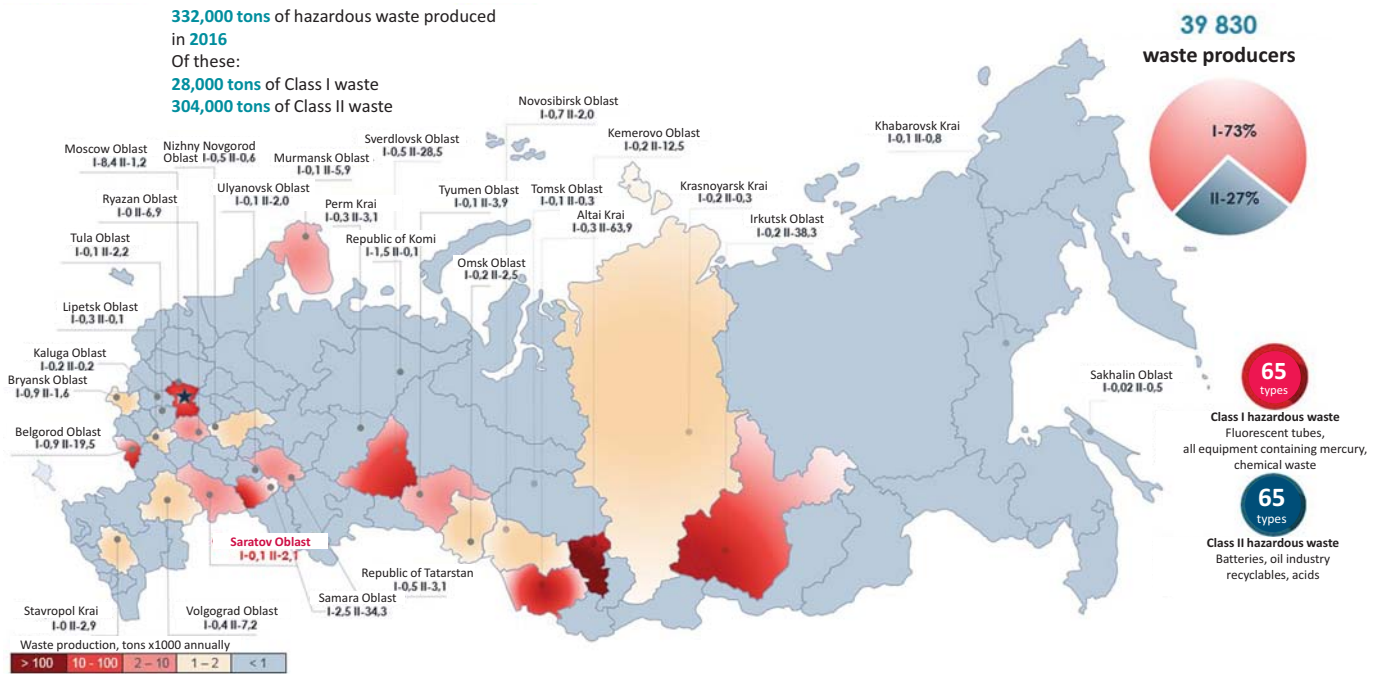
² See: <http://regulation.gov.ru/projects#npa=78522>; law draft ID: 02/04/02-18/00078522.

³ As stated by the Russian Ministry of Natural Resources and Environment (see: http://www.mnr.gov.ru/press/news/korporatsiya_rosatom_mozhet_stat_federalnym_operatorom_po_obrashcheniyu_s_opasnymi_otkhodami).

⁴ See: http://mineconom74.ru/sites/default/files/field_downloads/1323/infrastruktura12klassopasnosti.pdf).

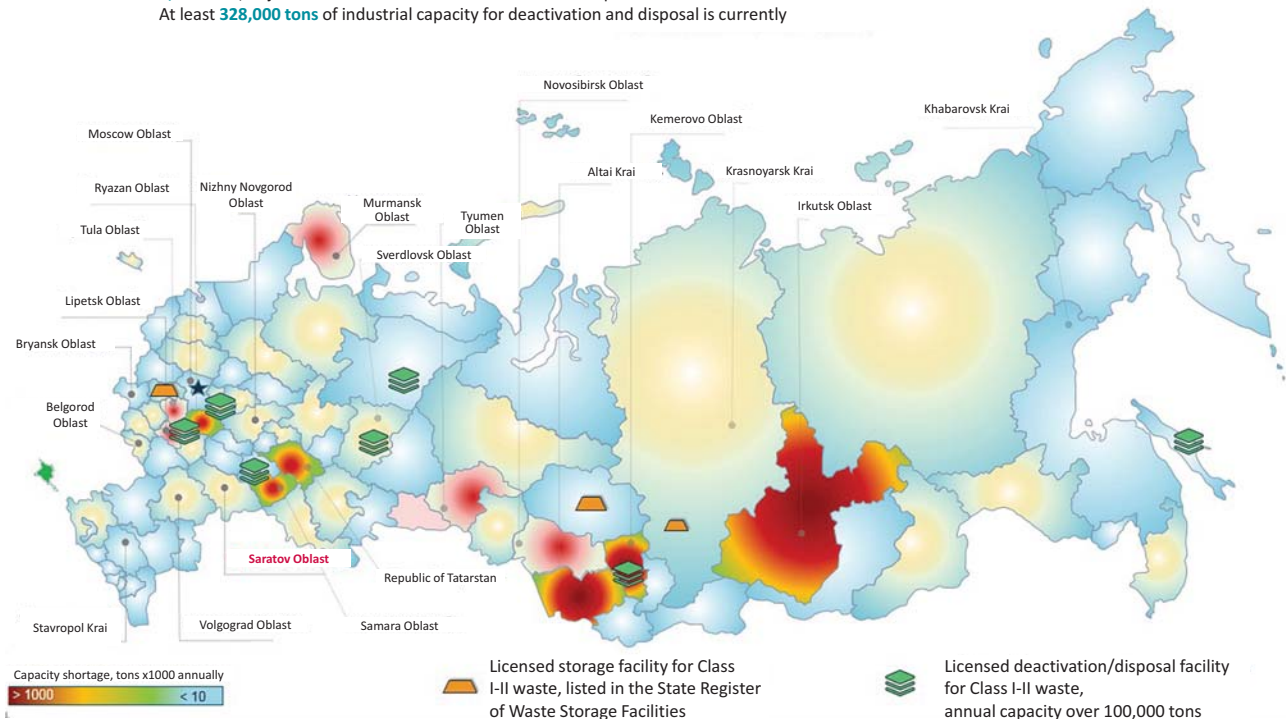
⁵ See: <http://uralfo.gov.ru/media/files/file/M9VAn4cljYxgAfOV37BOHfh2u28AmXJ.pdf>).

Accumulation of Class I and II hazardous waste in various federal subjects of Russia, 2016



Shortage of infrastructure for deactivation, disposal and storage of Class I and II waste

4,000 tons, or just 1.2% of all waste are deactivated and disposed under license.
At least **328,000 tons** of industrial capacity for deactivation and disposal is currently



weapons disposal facilities: Gorny (Saratov Oblast), Shchuchye (Kurgan Oblast), Kambarka (Udmurt Republic) and Maradykovsky (Kirov Oblast). 3 facilities will be constructed from the ground up: in Kemerovo Oblast, in Irkutsk Oblast, and on the border of Moscow Oblast and Leningrad Oblast.

Operational control on the chemical weapons disposal facilities was transferred from the Federal Department for Safe Storage and Disposal of Chemical Weapons to the federal operator of Class I-II hazardous waste (a subdivision of State Corporation Rosatom).

The project is due to start on 1 January 2019 and finish on 20 December 2024.

A more detailed timeline includes the following stages:

- 2018 – Development of legal regulations and procedures related to Class I and II waste handling (project for a federal law to make amendments into the Federal Law on State Nuclear Energy Corporation Rosatom and the Federal Law on Industrial and Consumer Waste, to make State Corporation Rosatom responsible for handling of Class I and II waste) (in fulfillment of the order No. Pr-2236dsp by the Russian President, effective 2.11.2017);
- 2018-2019 – Choosing the federal operator, building the infrastructure, signing contracts;
- 2019 – Putting into effect the federal framework for waste handling, putting into service the unified state information system for monitoring and control of Class I and II waste handling;
- 2020-2023 – Conversion of facilities for chemical weapons disposal into 4 industrial engineering complexes;
- 2020-2024 – Putting into service the 3 new industrial engineering complexes.

The suggested version of the program constitutes a request for federal funding. The ratio of governmental to non-governmental funding is already determined. Funding is distributed for each year of the project implementation. 532.95 million rubles will be necessary for development of legal regulations and data analytics; 35,819.00 million rubles will be required for implementation of infrastructure projects.

The indisputably strong point of the project is the fact that a unified framework for tracking and monitoring of Class I and II waste handling is to be created already on the first stage of the project. Currently, however, only the general idea of the project is clear, while its specific content is yet to be clarified.

The weakest parts of the program's passport are probably the following:

- No information on specific technologies for waste deactivation and disposal, to be used for conversion of chemical weapons disposal facilities, as well as design and construction of new facilities;
- No information on types and amounts of waste that currently lacks technologies for deactivation and disposal, and thus needs burial or long-time storage;
- No information on percentage of such waste in the total amount of Class I and II waste;
- No information on scientific research about the disposal of such waste, patented pilot installations, or pilot testing programs;

- No information on the current industrial technologies for deactivation and disposal of hazardous waste;
- It is unclear if any of the lacking information would be collected online, to help design new facilities with new scientific results;
- Regional needs for deactivation of specific types of waste are not defined; therefore, it is hard to make decisions about conversion of specific regional facilities, predict the necessary budgets, or set goals for deactivation of specific amounts of specific waste types.
- No predictions for future amounts of waste production, necessary to analyze the future demand for disposal capacities;
- No mentioning of collaboration with the existing manufacturers of waste deactivation equipment.

A significant question is left unanswered: Which contracts will the federal operator sign during the years-long conversion of facilities and construction of new complexes? If the contracts will involve permanent or long-time storage of waste without its mandatory deactivation, this would not stimulate the operator to create recycling facilities as fast as possible. Also, no ideas have been proposed to optimize the logistics of waste collection and shipping, while there is still a shortage of facilities for waste disposal and deactivation. An overwhelming majority of factories produce small amounts of hazardous waste; its long-haul shipping would be unprofitable for the operator. Costs might be optimized e.g. by creation of multiple sites for temporary storage, located in the best places concerning shipping costs and waste deactivation costs.

How much Class I and II hazardous waste is produced annually in Russia? Sergey Donskoy, in his letter to President Putin, cited a figure of 400,000 tons. A presentation of the federal project *Creation of Infrastructure for Safe Handling of Class I and II Hazardous Waste* cites data obtained from state statistical forms: 332,000 tons of hazardous waste, including 28,000 tons of Class I waste and 332,000 tons of Class II waste. The current situation of Class I and II waste handling was analyzed by state statistical forms 2-TP (Waste) for 2016. The developers acknowledge that forms 2-TP underreport waste amounts; however, they do not clarify how they plan to obtain the real amounts of waste produced by factories, or what would motivate the factories to reveal the true data. Disposal, deactivation and storage of Class I and II waste are expensive, so waste producers are not interested in showing the true amounts of their waste.

II. Problems of Building a Nationwide Management Framework for Class I and II Hazardous Waste

1. Lack of unified approach for waste classification

Class I hazardous waste traditionally includes polonium, benzopyrene, hydrogen fluoride, lead salt, thallium, mercury diethyl, plutonium, tellurium, hydrogen cyanide, etc. These substances may come from electric transformers, capacitors, mercury thermometers, mercury vapor lamps and fluorescent tubes.

Class II hazardous waste includes lithium, phenol, chloroform, sulfuric acid, selenium, hydrogen sulphide, barium, formaldehyde, antimony, vinyl benzene, all nitrites, arsenic,

molybdenum, etc. These substances come from batteries, oils, alkalies, acids, galvanic elements, leftovers from oil-containing waste.

In practice, designation of a specific waste to a particular class of hazard is regulated by two federal authorities: the Federal Service for Supervision of Natural Resource Usage (Rosprirodnadzor) and the Federal Service for Consumer Rights Protection and Human Welfare (Rospotrebnadzor). In fact, two different classifiers exist for the same waste, along with two different approval procedures by local authorities. Two different approaches manifest themselves already in terminology: hazardous waste (Rosprirodnadzor, State Standard 30772-2001, p. 3.26) or toxic waste (Rospotrebnadzor, State Standard 30772-2001, p. 3.28).

Rosprirodnadzor follows the Federal Law 89-FZ, distinguishing all waste into 5 classes of hazard designated by Roman numbers: Class I – extremely hazardous waste; Class II – highly hazardous waste; Class III – moderately hazardous waste; Class IV – low-hazard waste; Class V – nearly non-hazardous waste.

Rospotrebnadzor follows the Sanitary Rules 2.1.7.1386-03, *Sanitary Rules Defining Classes of Hazard for Toxic Industrial and Consumer Waste*, distinguishing the waste into 4 classes of hazard designated by Arabic numbers.

Russian environmental legislation requires a passport for any hazardous waste, defining its class of hazard (Art. 14 of the Federal Law 89-FZ). Russian sanitary legislation requires classifying any toxic waste by its class of hazard (Art. 22 of the Federal Law 52-FZ, On Sanitary and Epidemiological Wellbeing of the Population).

At the time of its checks, Rosprirodnadzor may require a passport for any hazardous waste defining its class of hazard, while Rospotrebnadzor may require justification for the class of hazard assigned to any hazardous waste (so-called sanitary class of hazard).

In fact, the two classifications of waste co-exist: Rosprirodnadzor may impose its own fines, while Rospotrebnadzor may impose its own. Rospotrebnadzor officially states that Rosprirodnadzor's classification was developed for environmental protection, while theirs relates to human wellbeing.

Lack of coordination impedes creation of a unified nationwide framework for waste management. The State Council meeting *On Environmental Development of the Russian Federation for the Benefit of Future Generations*, held on 27 December 2016, resulted in a list of instructions, one of which states a need to *modify the Russian legislation, to harmonize the environmental legislation with the sanitary and epidemiological requirements for the general populace, to develop a unified approach for waste classification*. This work is under way, but still not completed.

2. Uncoordinated actions by various authorities in the waste management framework

The lack of a unified waste management center is considered a problem by experts.⁶ There are, however, different opinions on the question whether a new authority is necessary for management of Class I and II waste. Some experts consider it reasonable to leave the Ministry of Nature as the only regulator, creating an Agency for Industrial and Consumer Waste Handling as its subdivision, similar to the Federal Agency for Water Resources.

⁶ E.g. Elena Esina, environmental law expert in the Russian President's Council for Civil Society and Human Rights Development.

3. Possibility for the federal operator to escape responsibility by lowering classes of hazard for waste

Regional operators currently exist only for solid municipal waste. A single federal operator is conceived only for Class I and II hazardous waste. For Class III and IV industrial waste, handling practices and disposal fees are still defined by the market. Experts in industrial waste handling agree that illegal disposal or reclassification into market-managed Class III and IV will be inevitable if the federal operator would handle only Class I and II hazardous waste, while Class III and IV waste would be left in the market sphere.

With the implementation of the new framework for Class I and II waste, increased monopolistic tariffs will be set. It is unlikely that the federal operator will offer flexible payment options or payment delays available now. This will drive companies away from the federal operator to the more flexible market of Class III and IV waste. As a result, companies will more frequently try to lower the class of hazard for their waste, issuing new waste passports and repeatedly including the waste into the Federal Catalogue for Waste Classification (FCWC).

In fact, waste producers already practice this frequently, reissuing passports for their waste to cut expenses for its disposal. According to the *Classification Rules for Class I–IV Waste*, established by the Ministry of Nature, class of hazard is determined by a waste's chemical and/or fractional composition listed in FCWC and waste database.

If a particular waste is not listed in FCWC, its class of hazard is determined by one of two criteria for waste classification by its negative effect on the environment, established by the Ministry of Nature: first, by severity of hazard for the environment (calculated); second, by the dilution factor of water extract from the waste that poses no threat for aquatic organisms (determined empirically). Waste passports are often based on the more loyal of these criteria. If a company seeks a new passport for its waste lacking in FCWC, with a lower class of hazard calculated, they may take a creative approach – mix two types of waste into a third type to be included in FCWC. Waste is sometimes diluted to reduce its class of hazard by criterion 2; sometimes dehydrated in a decanter (this method was used by a large company for Class III hydrofilter sludge; they obtained Class IV waste).

There are multiple ways to reclassify waste, and multiple specialized organizations offer help in drawing up waste passports and make them approved by Rosprirodnadzor and the Federal Center for Analysis and Assessment of Human Impact. If companies would manage to reclassify large amounts of Class II waste as Class III through passport reissuing and repeated inclusion in FCWC, the federal operator will fail to get the amounts of waste necessary for profitable investments into new recycling facilities. But even more important are the environmental consequences: Class II waste with 30-year recovery period may be shipped and stored as less hazardous waste.

4. Lack of reliable data about Class I and II waste in regional frameworks for waste handling

Some data concerning waste may be obtained from regional frameworks for waste handling. Russian Government Order No. 1130, issued 22.09.2018 and put into effect 3.10.2018, sets requirements for regional waste handling frameworks. When these frameworks were still under development, regional authorities were bound by the Russian Government Order

No. 197, effective 16.03.2016. A regional framework then had to include the following sections:

Section 1, *Location of Waste Sources*. Contains names, postal addresses and/or geographic coordinates of waste producers within the given federal subject of Russia.

Section 2, *Amount of Waste Produced*. Contains data on annual waste production categorized by types of waste (according to the Federal Waste Classification Catalogue) and classes of hazard.

Section 3, *Target Figures for Waste Deactivation, Disposal and Storage*. Contains the following data:

- target figures for waste deactivation, disposal and storage, established by the federal subject of Russia, as well as the progress achieved in these target figures (on the date when the regional framework was put into effect);
- percentage of disposed and deactivated waste in the total amount of industrial and consumer waste, in total and detailed by types and classes of hazard;
- percentage of buried waste in the total amount of industrial and consumer waste, in total and detailed by types and classes of hazard.

Section 4, *Locations of Waste Accumulation*. Contains data on the locations where waste is accumulated (also marked on the map of the Russian Federation).

Section 5, *Facilities for Waste Processing, Disposal, Deactivation and Storage*. Contains the following:

- names of facilities for waste processing, disposal, deactivation and storage within the given federal subject of Russia;
- postal addresses and/or geographic coordinates of facilities for waste processing, disposal, deactivation and storage;
- annual amounts of waste (in total and detailed by types and classes of hazard); amounts of waste processed, disposed, deactivated and stored.

Section 6, *Balance of Waste Produced, Processed, Disposed, Deactivated and Stored*.

Section 7, *Waste Flows Diagram*.

If the regional frameworks were properly maintained, they could readily provide information on Class I and II hazardous waste: its sources (including the amounts of each FCWC type of waste produced annually), places of its accumulation, facilities for its processing, disposal, deactivation and storage (including the amounts of waste recycled, deactivated, disposed and accumulated for each FCWC type and class of hazard).

5. No reclamation strategy for the existing landfills containing Class I and II hazardous waste

Lack of inventory tracking on waste accumulation sites is also a problem to be faced by the federal operator. In 1990s, when chemical factories were widely privatized and converted for other purposes, multiple waste accumulation sites became unattended due to bankruptcies of their owners. Many of these accumulation sites are absent from regional frameworks for waste handling.

HAZARDOUS WASTE MANAGEMENT PRACTICES IN SOME EU COUNTRIES

EU Regulation for Hazardous Waste Handling

Waste handling, including hazardous waste, is regulated on the European Union level by a number of directives compulsory for all EU member states. Various EU directives for waste have been adopted since 1975. The current framework *Directive 2008/98/EC of the European Parliament and of the Council of 19 November 2008 on waste and repealing certain Directives* was adopted in 2008. It describes the general policy for waste management, classifies waste types and methods for their recycling and disposal.

The Directive sets out a five-step priority hierarchy for waste handling solutions, from the most preferable to the least preferable:

- (a) Prevention of waste production
- (b) Prepare for re-use
- (c) Recycling
- (d) Recovery of materials or use as fuel for energy production
- (e) Disposal

The Directive acknowledges the waste categorization system previously set up by the European Commission (*Commission Decision of 3 May 2000*) – *European waste list, EWL*. This list categorizes various types of waste: first, by industries producing them; second, by technical processes leading to their production; third, by substances prevailing in the waste. Hazardous waste types are marked by * in the list. Currently, there are 289 types of hazardous waste in the list.

For example, category (05) *Wastes from petroleum refining, natural gas purification and pyrolytic treatment of coal*, subcategory (05 07) *Wastes from natural gas purification contains three types of waste: Sludges containing mercury (05 07 01*)*, *Waste containing sulphur (05 07 02)*, and *Wastes not otherwise specified (05 07 99)*. Of these three types, sludges containing mercury are considered hazardous.

Annex III to the Directive defines the properties which (any one or in combination) make a particular waste hazardous:

H 1 – ‘Explosive’: substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene.

H 2 – ‘Oxidizing’: substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances.

H 3 A – ‘Highly flammable’:

– liquid substances and preparations having a flash point below 21 °C (including extremely flammable liquids), or

- substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy, or
- solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition, or
- gaseous substances and preparations which are flammable in air at normal pressure, or
- substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.

H 3 B – ‘Flammable’: liquid substances and preparations having a flash point equal to or greater than 21 °C and less than or equal to 55 °C.

H 4 – ‘Irritant’: non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.

H 5 – ‘Harmful’: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks.

H 6 – ‘Toxic’: substances and preparations (including very toxic substances and preparations) which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.

H 7 – ‘Carcinogenic’: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence.

H 8 – ‘Corrosive’: substances and preparations which may destroy living tissue on contact.

H 9 – ‘Infectious’: substances and preparations containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms.

H 10 – ‘Toxic for reproduction’: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce non-hereditary congenital malformations or increase their incidence.

H 11 – ‘Mutagenic’: substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce hereditary genetic defects or increase their incidence.

H 12 – Waste which releases toxic or very toxic gases in contact with water, air or an acid.

H 13 – ‘Sensitizing’: substances and preparations which, if they are inhaled or if they penetrate the skin, are capable of eliciting a reaction of hypersensitization such that on further exposure to the substance or preparation, characteristic adverse effects are produced.

H 14 – ‘Ecotoxic’: waste which presents or may present immediate or delayed risks for one or more sectors of the environment.

H 15 – Waste capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics listed above.

In addition to the list of waste types, the EC directive sets up a list of properties which are required to categorize a particular waste as H3 to H8, H10, or H11. Any waste displaying one or more of the following properties is classified as hazardous and falls into one of the categories set up in Annex III to the Directive:

- flash point $\leq 55\text{ }^{\circ}\text{C}$;
- contains one or more substances classified as very toxic at a total concentration $\geq 0.1\%$;
- contains one or more substances classified as toxic at a total concentration $\geq 3\%$;
- contains one or more substances classified as harmful at a total concentration $\geq 25\%$;
- contains one or more corrosive substances classified as R35 (causes severe burns) at a total concentration $\geq 1\%$;
- contains one or more corrosive substances classified as R34 (causes burns) at a total concentration $\geq 5\%$;
- one or more irritant substances classified as R41 (risk of serious damage to eyes) at a total concentration $\geq 10\%$,
- contains one or more irritant substances classified as R36, R37, R38 (irritating to eyes, respiratory system, or skin) at a total concentration $\geq 20\%$;
- contains one or more substances known to be carcinogenic of category 1 or 2 at a total concentration $\geq 0.1\%$;
- contains one or more substances toxic for reproduction of category 1 or 2 classified as R60, R61 (may impair fertility or cause harm to the unborn child) at a total concentration $\geq 0.5\%$;
- contains one or more substances toxic for reproduction of category 3 classified as R62, R63 (possible risk of impaired fertility or harm to the unborn child) at a total concentration $\geq 5\%$;
- contains one or more mutagenic substances of category 1 or 2 classified as R46 (may cause heritable genetic damage) at a total concentration $\geq 0.1\%$;
- contains one or more mutagenic substances of category 3 classified as R40 (limited evidence of a carcinogenic effect) at a total concentration $\geq 1\%$.

Annex to the Directive 2008/98/EC lists all acceptable methods for waste recycling and removal.

Disposal operations

D 1 – Deposit into or on to land (e.g. landfill, etc.);

D 2 – Land treatment (e.g. biodegradation of liquid or sludgy discards in soils, etc.);

D 3 – Deep injection (e.g. injection of pumpable discards into wells, salt domes or naturally occurring repositories, etc.);

- D 4 – Surface impoundment (e.g. placement of liquid or sludgy discards into pits, ponds or lagoons, etc.);
- D 5 – Specially engineered landfill (e.g. placement into lined discrete cells which are capped and isolated from one another and the environment, etc.);
- D 6 – Release into a water body except seas/oceans;
- D 7 – Release to seas/oceans including sea-bed insertion;
- D 8 – Biological treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12;
- D 9 – Physico-chemical treatment not specified elsewhere in this Annex which results in final compounds or mixtures which are discarded by means of any of the operations numbered D 1 to D 12 (e.g. evaporation, drying, calcination, etc.);
- D 10 – Incineration on land;
- D 11 – Incineration at sea (this operation is prohibited by EU legislation and international conventions);
- D 12 – Permanent storage (e.g. emplacement of containers in a mine, etc.);
- D 13 – Blending or mixing prior to submission to any of the operations numbered D 1 to D 12;
- D 14 – Repackaging prior to submission to any of the operations numbered D 1 to D 13;
- D 15 – Storage pending any of the operations numbered D 1 to D 14 (excluding temporary storage, pending collection, on the site where the waste is produced).

Recovery operations

- R 1 – Use principally as a fuel or other means to generate energy (mainly incineration of municipal solid waste; energy efficiency must be over 0.60 for installations approved before 1 January 2009, or 0.65 for installations approved since 31 December 2008);
- R 2 – Solvent reclamation/regeneration;
- R 3 – Recycling/reclamation of organic substances which are not used as solvents (including composting and other biological transformation processes);
- R 4 – Recycling/reclamation of metals and metal compounds;
- R 5 – Recycling/reclamation of other inorganic materials (this includes soil cleaning resulting in recovery of the soil and recycling of inorganic construction materials);
- R 6 – Regeneration of acids or bases;
- R 7 – Recovery of components used for pollution abatement;
- R 8 – Recovery of components from catalysts;

R 9 – Oil re-refining or other reuses of oil;

R 10 – Land treatment resulting in benefit to agriculture or ecological improvement;

R 11 – Use of waste obtained from any of the operations numbered R 1 to R 10;

R 12 – Exchange of waste for submission to any of the operations numbered R 1 to R 11;

R 13 – Storage of waste pending any of the operations numbered R 1 to R 12 (excluding temporary storage, pending collection, on the site where the waste is produced).

This classification of waste handling methods is used both for hazardous and non-hazardous waste.

EU legislation for waste handling requires all EU member states to integrate all European directives into their national legislations. So, all EU countries currently have very similar legislations for hazardous waste management. However, organizational methods and law enforcement practices are different.

Key elements to be integrated into national laws:

- Each country must develop a plan for waste management, including hazardous waste. Such plans must be assessed and revised at least once every 6 years.
- Member states must take all necessary action to prevent formation of unattended hazardous waste, its uncontrolled disposal into the environment, or other kind of disposal. Violations of these terms must be punishable by effective, proportional, restrictive fines.
- Hazardous waste producers, collection facilities, shipping operators, and any entities dealing with hazardous waste must keep timely logs for amounts, types, and origins of the waste; if relevant, they also must log destinations, frequency of collection, means of transport, and handling methods for hazardous waste. This information must be provided to authorities by demand. Authorities must regularly check the aforementioned facilities.
- Hazardous waste must not be mixed with other categories of hazardous waste, as well as other waste, substances, or materials. Mixing also includes dilution of hazardous waste.
- Hazardous waste must be specially packed and marked during collection, shipping, and temporary storage.

There are separate directives concerning management of specific types of waste, e.g. End of Life Vehicles Directive or Electronic Waste Directive.

GERMANY

Germany ranks first among EU member states by the amount of hazardous waste it produces, as well as second in law enforcement and compliance of its national legislation with EU requirements. An assessment made by the European Commission in 2015 concluded that all general requirements of EU directives were present in German national and regional legislations. The actual management of hazardous waste, as well as law enforcement practices were also rated favourably. Drawbacks were revealed on the regional level. Two of 16 regional waste management plans lacked an outline of the principal sources for hazardous industrial waste. The national plan for prevention of waste production also lacks specific target figures for reduction of hazardous waste amounts.

Drawbacks were also revealed in waste handling practices. The share of waste solvents sent for recovery/regeneration (not including incineration for energy) is below 75%. The share of electronic devices collected separately is also insufficient. The principal method for hazardous waste handling in Germany is disposal at landfills or underground, even if we include exports and exclude imports of waste.

As an EU member state, Germany has integrated waste management directives into its national legislation, including the list of waste types. The latter was integrated into the Law on Waste Classification (*Abfallverzeichnisverordnung – AVV*). To help businesses better understand the European classification, German Federal Ministry of Environment (BMU) has issued a manual for waste types list usage (*Hinweise zur Anwendung der AVV*) which explains the criteria necessary for deeming a particular waste hazardous.

Other federal documents regulating hazardous waste management include:

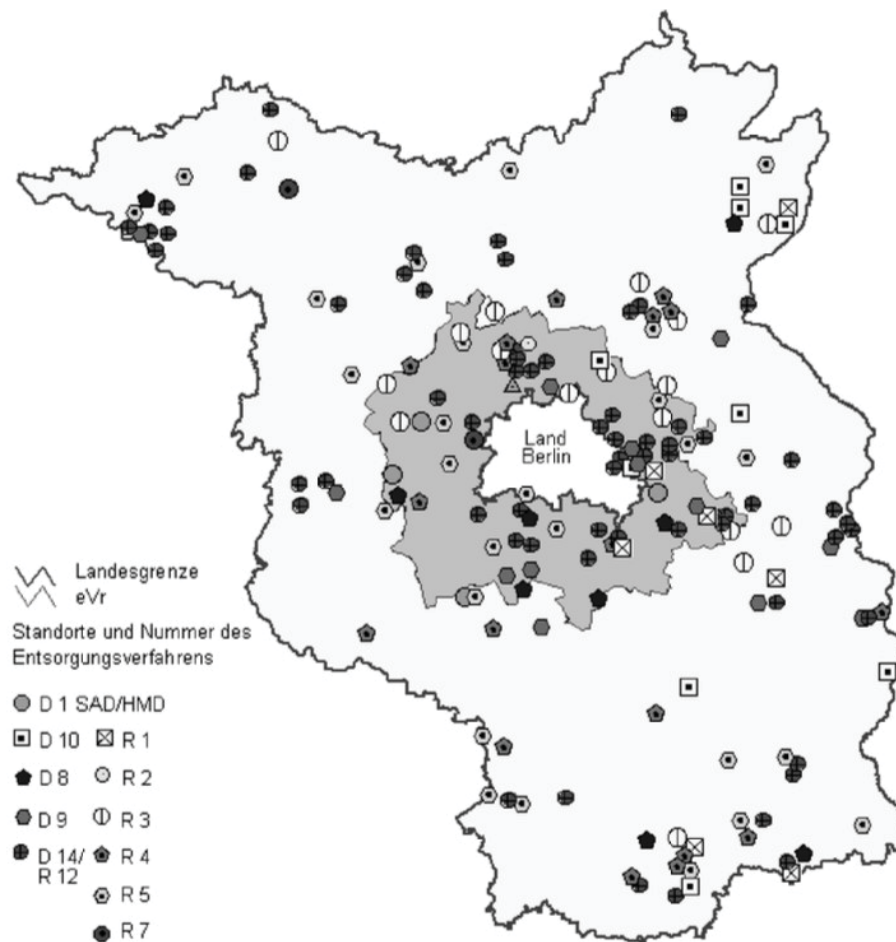
Technical guidelines for waste disposal (*Technische Anleitung Abfall – TAAbfall*), Provision 17 of the Federal Law on Environmental Pollution Control (*17. BImSchV*), and Part 2 of the Provision on Recycling and Disposal Proofs (*Verwertungs- und Beseitigungsnachweise – NachwV*). There are also separate laws and provisions that regulate disposal of specific waste types: used oils, electronic products, end-of-life vehicles, etc.

The German policy sets up some principles for hazardous waste management:

- Minimize shipping. Hazardous waste must be disposed as close as possible to the place of its origin, provided that all measures are taken to protect the environment and public health. A special permission is required for hazardous waste shipping.
- Manufacturers' responsibility. Any manufacturer is responsible for the complete life cycle of its goods, including their disposal after the end of life. This should promote responsible manufacturing practices and the development of circular economy. In line with this principle, manufacturers offer their customers return services for end-of-life goods.

Waste management, including hazardous waste, is mainly the responsibility of local authorities. Each region develops its own plan with a description of current situation, a list of all facilities for waste recycling and disposal, a summary of current trends in waste collection and management, and a list of regional regulations.

For example, Brandenburg region has its own Law on Waste (*BbgAbfG*) and the Directive on Special Waste Disposal (*SabfEV*), as well as a plan for hazardous waste management, approved in 2006 and still in effect.



**Fig. 1 Map of facilities that recycle and/or dispose hazardous waste in Brandenburg, as of 2003
(from Brandenburg regional plan for hazardous waste management)**

The law requires mandatory monitoring of hazardous waste producers, disposal facilities, shipping operators, and collectors. The monitoring consists of the following:

- Checking the mandatory accompanying documentation (disposal proofs, shipping notes, etc.). Since 2010, the documentation is obtained, stored, and checked electronically.
- On-site checks.

The monitoring is performed by the regional Environmental Authority (LUA). Electronic documentation flow is performed by Sonderabfallgesellschaft Brandenburg / Berlin mbH (SBB) – Germany’s largest operator of hazardous waste.

SBB is a public-private partnership created for hazardous waste management in Brandenburg and Berlin. It also supervises exports and imports of hazardous waste in Brandenburg and Berlin, including foreign movements. The company offers a wide range

of consulting services in hazardous waste management, issues licenses for disposal facilities and certificates of waste disposal for waste producers (if the waste was disposed in Brandenburg or Berlin), acknowledges tender results for waste disposal, and issues permits for international shipping of hazardous waste.

In other regions of Germany, the role of SBB is performed by other public-private partnerships, or subdivisions of regional ministries/committees for environmental protection.

Like all EU countries, Germany has a program for prevention of hazardous waste production. The program aims to:

- Reduce the amount of waste
- Reduce the negative effects of waste
- Reduce the amount of contaminants in goods, replace them with safer substances

Statistics:

Amount of hazardous waste	21.8 mln tons (2014) Composition of hazardous waste in 2012: W121: mineral construction waste (4,438 kt; 20%) W02A: chemical waste (2,701 kt; 12%) W128_13: mineral waste from recycling or deactivation of other waste (2,608 kt; 12%)
Percentage of hazardous waste recycled/disposed	(2014) 22.5% – disposed at landfills or underground facilities 0.18% – liquid waste deactivated and released into the environment 6.2% – incinerated with no energy produced 13.6% – incinerated with energy produced 10.6% – pumped into mines 47% – other
Target figures	According to the 2012 Law on Circular Economy: – 65% of electronic waste should be collected in 2019

UNITED KINGDOM

Being an EU member state, the United Kingdom must also comply with EU directives for hazardous waste management. All mandatory norms are stated in the national legislation. The United Kingdom ranks 4th in the EU by the amount of hazardous waste it produces.

Waste management in general, including hazardous waste, is regulated by the

The Department for Environment, Food and Rural Affairs. Specific tasks concerning waste management and monitoring are delegated to regional semi-autonomous State Environmental Agencies. The practices of hazardous waste management are based on regional licensing. Shipping or recycling of hazardous waste require a specific permission from the appropriate regional agency. A separate license is required for each operation, except some recycling operations for electronic waste and residue oils in England and Wales.

The producer of hazardous waste is responsible for its separate collection, proper classification according to the EU list, and safe temporary storage at the place of origin. The producer cannot ship any hazardous waste on its own without a special shipping permission.

Consignment notes must accompany any hazardous waste from the moment it left its place of origin until its final disposal. When a hazardous waste is recycled or disposed, the operator must draw up a disposal statement. Any facility recycling or disposing hazardous waste must send disposal statements to the waste producers and the Environmental Agency on a quarterly basis.

Hazardous waste producers must keep the consignment notes and disposal statements for at least 3 years. Shipping operators must keep the consignment notes for at least 1 year. Recycling/disposal facilities must keep the documents for at least 5 years. Facilities disposing hazardous waste must keep the documents for the whole license term. Facilities that don't require a permission must keep the documents for at least 3 years. Documents may be kept in paper or electronic format.

In England, there are multiple private companies holding permits for shipping and/or recycling and disposal of hazardous waste. The complete list is publicly available on the UK Government website.

In 2010, in compliance with the EU directive, the UK adopted regional plans for waste management (e.g. A strategy for hazardous waste management in England). About half of all hazardous waste in the UK is disposed at landfills. According to the strategy for hazardous waste management in England, England and Wales have a total of 24 landfills for hazardous waste. There are also about 50 landfills for non-hazardous waste with special areas for stable hazardous waste, such as asbestos.

Some facilities recycling household waste can also accept hazardous household waste. As the amount of hazardous waste accepted at the facilities is growing, it is planned to increase their capacity to provide safe separated storage of hazardous waste. The latter may include asbestos panels, electronic devices (TVs, computer monitors, refrigerating equipment, fluorescent lamps), automotive products including spent oils and batteries, certain types of paints and other products related thereto, certain household and garden chemicals.

The hazardous waste management strategy sets no target figures, but defines a general goal of stopping the practice of hazardous waste disposal at landfills. One of the measures aimed at reduction of such disposal is planned cancellation of tax relief for disposal of contaminated soil at landfills. Statistic data show that construction waste, including soil, makes a significant part of hazardous waste disposed at landfills. As a parallel measure, technical requirements for hazardous waste landfills will be tightened.

A separate document defines requirements for waste disposal at landfills, including for hazardous waste. The document also sets the requirements for environmental safety of landfills for various types of hazardous waste (Waste acceptance at landfills).

If a new recycling technology for a specific type of hazardous waste is currently being developed or implemented, temporary storage of the waste may be preferred over its disposal at landfills, provided that appropriate safety measures are taken to protect the environment and human health.

The strategy also includes an analysis of future demand for recycling facilities. For example, every year the UK produces about 350,000 tons of spent oils that require processing. The current facilities can handle about 70,000 tons per year. The Environmental Agency has estimated that the current demand requires construction of at least one modern installation for spent oils recycling with a capacity of 80,000 tons per year. This will allow the UK to meet its demand for base lube oil and increase the share of hazardous waste being recycled, as regeneration of waste oil stands higher than incineration for energy in the hierarchy of preferred waste handling methods.

Statistics:

Amount of hazardous waste	5.8 mln tons (2014)
	Composition of hazardous waste in 2012:
	W081: End-of-life vehicles (1,641,000 tons; 19%)
	W02A: Chemical waste (1,449,000 tons; 17%)
Share of hazardous waste recycled/disposed	W124: Waste from incineration (986,000 tons; 12%)
	Waste treatment – 2,762,500 tones, including:
	D1, D5, D12 – 869,000 tons
	D10 – 241,000 tons
	R1 – 103,000 tons
	R2-R11- 1549,000 tons
Target figures	Reduce the amount of hazardous waste going to landfills (no specific figures)

A revision conducted by the European Commission in 2015 revealed that hazardous waste management in the UK is slightly better than the EU average. It was noted that the UK is one of the few countries that offers exclusions from its licensing policy for hazardous waste management, which is a violation of EU requirements. However, in all other criteria (planning for hazardous waste management, compliance with hazardous waste legislation, responsibility for violations) the UK fully complies with EU standards. Notable drawbacks include a lack of target figures in UK plans for hazardous waste management, insufficient share of electronic waste and batteries collected, and a large amount of hazardous waste being buried.

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